THE POISON WAR

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INTRODUCTION

This book (with the exception of a few up-to-date additions) was written in March last. Publication having been delayed, in order to ascertain, according to the march of events, the advisability of including other matter, and it being my honest intention to exclude all information which could be of the slightest possible service to our enemies, the particulars referred to are not mentioned. The remarks upon scientific subjects affecting the war are merely intended to save the public continual reference to technical works, sometimes not easy of access. There is nothing so wholesome as the light of day. The perfidious dual rôle played by Germany for years past, during international discussions upon the customs of civilized warfare, will be better appreciated if I say that the bulk of the Teutonic poison shells recently recovered by the French bear the date "1911," (*see* p. 65) and that the poison-gas asphyxiating apparatus (*see* Figs. 2 and 3, pp. 25 and 35) was under German military consideration in the year 1909. The date of the last Hague Conference was 1907. It will be gathered from the Appendices hereto, that the United Kingdom only consented to the non-usage of asphyxiating gases in warfare, provided the abstention was

maintained by any aggressive State. Should a belligerent resort to such practices to our disadvantage, this country claimed similar right by way of retaliation. Lord Kitchener has now announced Great Britain's intention to adopt such protective measures as may be deemed necessary to effect reprisal. In its strict sense, the latter term indicates the retortion upon an enemy for an act of breach of faith, by the infliction upon such enemy of suffering. Scipio has taught us that such infliction should be upon those bearing arms. It does not, however, follow that the British War Department, adopting asphyxiating gases, will make usage of the same methods of torture in warfare as those employed by the Germans.

I am indebted to eminent French experts, named herein, for information which they kindly furnished—and to the authors of technical works, a list of which will be found in the Bibliography at the conclusion.

A. A. R.

LONDON,
May 20, 1915.

PRO GLORIA ET PATRIA

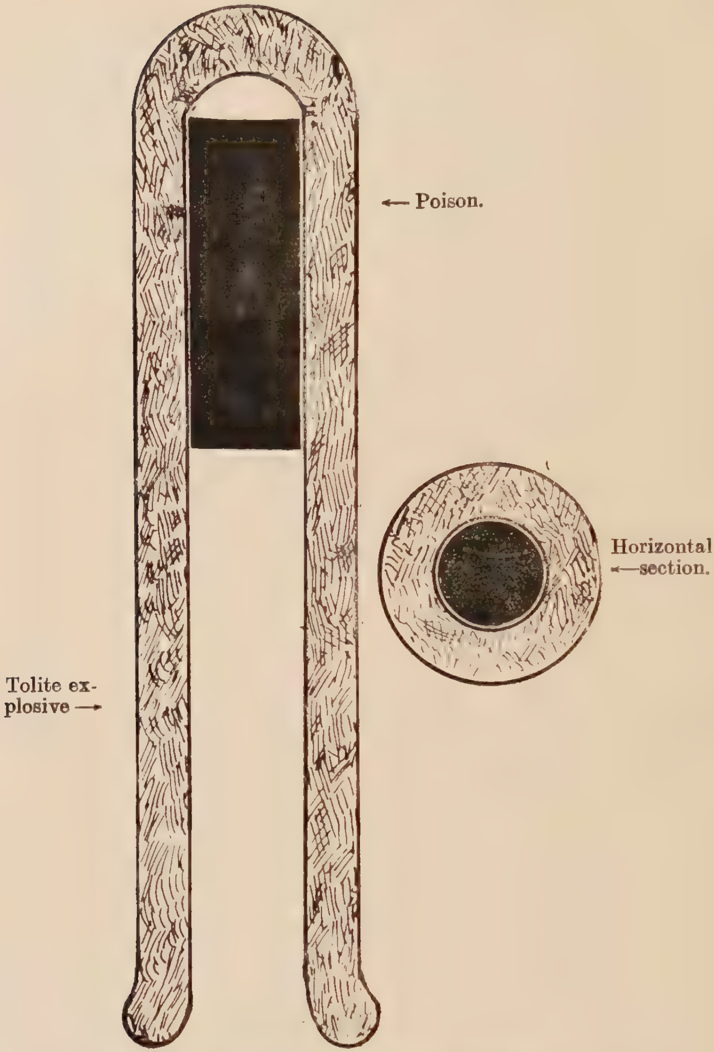


FIG. 1. The tolite (explosive) tube, contained in a "77" cm. German, common shell. In the centre is the poison. (*See* p. 64.)

The guns are emblazoned with arms surmounted with the words PRO GLORIA ET PATRIA. (*See* p. 66.)

ARTICLE I

ASPHYXIATION IN WARFARE : NITRIC-PEROXIDE : THE HAGUE CONVENTION ERROR : AMERICAN VIEWS : TORTURE IN WARFARE : THE GERMAN OFFENCE SUMMARIZED : THE FRENCH "75" SHELL IN COMPARISON WITH THE GERMAN "77" : THE LAND POISON-GAS MACHINE : CARBON-MONOXIDE : CHLORIN AND BROMIN : SULPHUR DIOXIDE : THE NAVAL POISON-GAS MACHINE : BLOWING UP THE ENEMY : RESTORING THE ASPHYXIATED : THE PULMOTOR : THE OXYGEN HELMET : HAND-GRENADES AND BOMBS

THE glory of victory cannot be adequately attained by our adversary with the systematic poisoning of the troops as described in Article II, for he is now officially credited with the asphyxiation of the Allied Forces. Given that it has fallen to our lot to submit to such savagery, let it be known that—in so far as the present appliances are concerned—asphyxiation, if painlessly conducted, is to be preferred to the insidious poisoning by long-range gun fire, such as is hereinafter detailed. Poisoned shell fragments and bullets can be fired at long range and find a billet, but it remains to be seen whether the adaptation by the Teutons of ancient methods to modern warfare has yet advanced to such a stage that poison gases, conveyed by hand-grenades and by such apparatus as the enemy is now employing,

may prove really effective in any other than trench warfare. It is nothing but the close proximity of the adversaries in fighting which has led to the introduction by the Germans of so many weapons long lost in oblivion. Certainly the instruments and plant, of which I give details, are only those with which the Germans were experimenting years ago, and their non-effectiveness at long range and dependence upon atmospheric conditions is as well known to the enemy as to our own commanders. Also one has to take into consideration the ready means of combating the toxic power of any such agent utilized; whether it be chlorin, bromin, nitric-peroxide, or carbon-monoxide, the same remark fully applies.

Months ago I drew public attention to the probable usage by the enemy of asphyxiating projectiles. These conclusions I arrived at mainly as the result of observations in the Balkans during the late war.

Speculation has recently been rife as to what might be the particular nature of the toxic means employed. The fact, however, seems to have been overlooked that the Germans are not making use of one particular gas, but of at least three. These they naturally employ according to the military exigencies of the moment and the amount of their supplies obtainable. For instance, it is clear that the gas used recently is not of the same nature as that which the

French formerly experienced. These circumstances may possibly account for the divergence of views expressed by our scientists. I said, on April 25, in the *Observer* that the Germans had already made use of carbon-monoxide and nitric-peroxide, and in the *Pall Mall Gazette* of April 27 that the effect of the carbon-monoxide would be action upon the hæmoglobin * of the blood, and that "the blood of a person inhaling it will gradually become more and more inactive. As to antidotes, better than cure is prevention, and in order to prevent the advance of troops into a suspectedly poisoned area the simple expedient of setting free small birds cannot fail to be effective. I have noticed that of this gas 0·25 per cent. affects a bird in 51 seconds, but this percentage would not suffice to kill troops on sudden exposure. The same may be applicable to some other gases capable of usage in warfare.

"A German chemist in the Balkans, during the last war informed me there that he had assisted in the discovery of a method by which carbon-monoxide could be successfully utilized in warfare at close quarters, notwithstanding the slight density difference."

Continuing in the same communication, I said in relation to nitric-peroxide that "it will be easily perceptible by its distinct odour. The disadvantage, apart from chemical reasons, in

* The colouring matter of the red blood-corpuscles.

its employment will be the delay in the appearance of symptoms.

"Troops may notice nitrous fumes and recover, retiring visibly little affected, only to succumb subsequently to convulsions or pneumonia. Inhalation of oxygen is the antidote. In the case of nitrous fumes a violent fit of coughing will probably be set up, followed by the most acute form of broncho-pneumonia."

It is noteworthy that a renowned expert upon this topic, Monsieur Eugène Turpin, was interviewed on or about April 20 last. The Special Correspondent of the *Daily Mail* wired the result of the interview, and the message was published in that paper on April 29. In effect, M. Turpin said that the Germans had made use of nitric-peroxide—this view being borne out by eminent French experts who had visited various scenes of battle. In M. Turpin's opinion the ready remedy was to be found in the usage of ammonia by the troops.

In view of the official report set forth by Dr. Haldane and published by the Press Bureau on April 29, I have no reason to retract the statements I made prior to that date. The toxicological effect of chlorin and bromin may be briefly described for the purposes of explanation as being the same as that of the other gases mentioned.

Official Report. The Secretary of State for War reported on April 29 that Dr. Haldane had

written, "These men were lying struggling for breath. . . . One of them died shortly after our arrival. A post-mortem examination was conducted in our presence by Lieutenant McNee, a pathologist by profession, of Glasgow University. The examination showed that death was due to acute bronchitis and its secondary effects. There was no doubt that the bronchitis and accompanying slow asphyxiation were due to the irritant gas."

The resourceful Canadians appear to have found relief from the noxious fumes by the usage of handkerchiefs soaked in the liquid contents of bottles of pickles. This recalls the conduct of the troops in the Boer and Balkan Wars. The Boers professed to scorn our lyddite gas, provided they had a sufficiency of vinegar at hand.

Nitric-Peroxide. There are five oxides or derivatives of nitrogen, amongst these being nitrous oxide, known as "laughing gas," and prepared from nitrate of ammonium; and nitrogen peroxide, prepared by several methods, as from nitrate of lead. The "laughing gas," owing to its properties of anæsthesia, is much utilized for dental and other minor operations. When inhaled in a dilute measure it produces a form of intoxication. Nitric-peroxide is a poisonous volatile liquid giving off irritant fumes of a brownish colour. It causes a remarkable condition of asphyxiation, which may or may not be temporary. The trouble is that the real

effects of nitric-peroxide may only become apparent some hours after inhalation. Cases have many times been recorded of men who having inhaled the fumes were deemed to have almost recovered from the effects. Nevertheless they succumbed that night, or in some cases upon the following day.

Seeing that both carbon-monoxide and nitrogen-peroxide are liberated upon the explosion of the ordinary projectiles of modern warfare, in use by all the Powers engaged in the present struggle, the German Press thinks to mislead the world by the publication of official and semi-official excuses, setting forth that the gases of which they are making usage "are no worse than those employed in the Russian, French, and English shells."

"Frankfurter Zeitung." The *Frankfurter Zeitung* states that "the reports of Joffre and French unite in complaining about the use of bombs filled with asphyxiating gas—Field-Marshal French even takes occasion to quote The Hague Convention—and both commanders ascribe the retreat of their troops to the infection of the air in the region of their fighting lines. It is quite possible that our bombs and shells made it impossible for the enemy troops to remain in their trenches and artillery positions."

Hague Convention. In the Appendices hereto will be found the clauses of The Hague Conven-

tion Declaration affecting this vexed question. In reality the one and only object of the German Press campaign is to endeavour to convince neutrals that they do not employ projectiles, the SOLE OBJECTIVE of which is asphyxiation, and that they do not employ poisonous missiles in their artillery.

Error in the Text. Germany is well aware of the clerical error in the official translation of the Declaration, which was made originally in French. As I pointed out, in the *Observer*, the translation of the French text should have read: "*Sole* object of which is the diffusion of asphyxiating or deleterious gases," the words of the official document being "qui ont pour but UNIQUE." The English text reads, "THE OBJECT of which is the diffusion," &c. The translation of the all-important word "unique" has been accidentally omitted (*see* Appendix III, p. 131), and this furnishes the Germans with an excuse to act as they do act.

The painless asphyxiation of troops can hardly be said to constitute any greater crime against humanitarian laws than the blowing to pieces of soldiers in warfare. Therefore, at the most, Germany desires to figure before the world merely as having violated that which in Teutonic eyes is just a "scrap of paper." In effect, the German Press arguments imply the following reasoning: "You signed, and we signed, but prior to such signature your delegates stated that they

declined abstention unless the observance was unanimously maintained. Now we find it no longer necessary to observe these clauses, and you will therefore be equally at liberty." * Considerable emphasis has also been placed by Germany upon the remarks of the American naval delegate when objecting to become a party to the Declaration. Captain Mahan, after having set forth other objections, stated "that he considered the use of asphyxiating shell far less inhuman and cruel than the employment of submarine boats, and as the employment of submarine boats had not been interdicted by the Conference (though specially mentioned with that object in the Mouravieff Circular) he felt constrained to maintain his vote in favour of the use of asphyxiating shell on the original ground that the United States Government was averse to placing any restriction on the inventive genius of its citizens in inventing and providing new weapons of war."

As a matter of fact, the world's leading jurists have differed materially in opinion as to whether or no, in view of the altered circumstances of modern warfare, painless asphyxiation is justifiable. Now just as the word "UNIQUE" or "SOLE" plays the all-important rôle in this matter, so is there much dependent upon the

* It was agreed, however, that one year's notice should be given of any intention to denounce the Declaration (*see* Appendix III, p. 131).

word "painless" (which the German Press deletes with the utmost care from its criticisms). For with the introduction of painful methods of suffocation, such as those officially described as resulting from the German bombs and gases, we find ourselves face to face with an enemy, resorting not merely to asphyxiation as a means of defence and offence, but TORTURE IN WARFARE.

Torture in Warfare. In so far as contravention of the "scrap of paper" is concerned this constitutes a direct infringement of Article 23 (E) of the Regulations of The Hague Convention (*see* Appendix I, p. 127), but that is by no means all. Long before the existence of The Hague Convention—in fact, from time immemorial—torture in warfare has been condemned.

Grotius, practically the founder of modern international law, in his great work, "De Jure Belli ac Pacis," 1625, quotes many instances in support of these contentions. De Vattel (1758), referring to such abominations, says, "He who makes use of such methods is not innocent before God and his conscience. *The Sovereign practising such execrable means should be accounted the enemy of mankind, and the common safety calls on all nations to unite against him and join their forces to punish him.*" Further historical references to this issue will be found in Article II, dealing with the systematic poisoning of our troops, as practised by the Germans.

Asphyxiation: to what extent justified. In order to arrive at safe conclusions, it is necessary that the public should clearly comprehend what constitutes justifiable or unavoidable asphyxiation in modern warfare. Asphyxiation, in a general sense, means suffocation. That caused by carbon-monoxide is known as asphyxia carbonica. An inevitable consequence to the advance of science, as applied to modern explosives, is the *occasional* production of asphyxia, or semi-asphyxia. This may be briefly ascribed to five reasons, viz.:

(i) The initial velocity of a projectile.
(ii) The rapidity of shell fire.
(iii) Ricochetting power prior to explosion.
(iv) The bursting height of a shell.
(v) Chemical constituents of the modern artillery shell.

Now German officers in the present war, and the German newspapers, have frequently stated that the French employ in their "75" shell an explosive "the objective of which is asphyxiation." "Ce n'est pas un canon de guerre que vous possédez, c'est un canon de boucherie," explained a German military critic to a French officer.

The "75" Shell. The French "75" shell does not owe its properties of asphyxiation to the materials employed any more than shells universally used in warfare. The "75" common shell, which weighs about 11 lb. and has an initial velocity of about 529 metres, is filled

with melinite, to which there is an addition of cresylite (*see* p. 94). Cresylite does not materially alter the explosive properties. It is chiefly employed to facilitate the pouring of molten melinite into its receptacle. Generally, these shells contain 60 parts of cresylite to 40 of melinite. Upon explosion, a heavy black smoke is given off, and the shells have been known to cause destruction within a radius of 21 yards of the bursting point. They are known to French artillerists as "L'OBUS JAUNE" (the yellow shell).

The "75" shrapnel shell, weighing about 15½ lb., is made of three different kinds, known as "97," "96A," and "97M." But beyond the facilitation of observance in bursting there is little of importance as between the three varieties. As a filling for shrapnel "75" shells, the poudre B, or smokeless powder, is used.

From the foregoing particulars it may be assumed that the German Press statements have no foundation in fact.

The German "77" compared. One only needs to study the rapidity of fire, initial velocity, and manner of bursting of these French projectiles, as compared with those of the analogous German "77," to arrive at the reason of the German discord.

The French "75" gun is capable of firing 25 rounds per minute, against only 10 rounds of the German "77." The initial velocity of the "75"

shell will be 529 metres, as compared with only 465 metres, under similar conditions, of the German "77," but the weight of the German common shell is about the same as that of the French. Upon bursting, however, there is a difference of about 10 yards, in the extent of the danger zone of the French shell, in excess of the German. The manner of bursting, in the case of the "75," is totally different from that of the German shell, as the former strikes the ground, or other obstacle, prior to explosion, and bursts directly before its objective. These brief comparisons are quite sufficient to show that:

(*a*) The French gun conforms to the rules of the "prize ring."

(*b*) That there is nothing unlawful in the effect of the projectiles.

Now as to the so-called asphyxiation, an outcome of modern artillery fire in general, very little was known of this subject until the Balkan War. During that campaign several specialists devoted themselves to the study of this remarkable phenomena, and I had the opportunity of frequent conversation with some of them. Professor Laurent describes the symptoms as those of cerebro-medullary shock, which is now termed "shell shock." It may be only slight or it may be severe. To quote Laurent: "When of a graver kind it causes arrest of functions; the wounded man falls into torpor, becomes inert as if absolutely crushed, and all four limbs and the

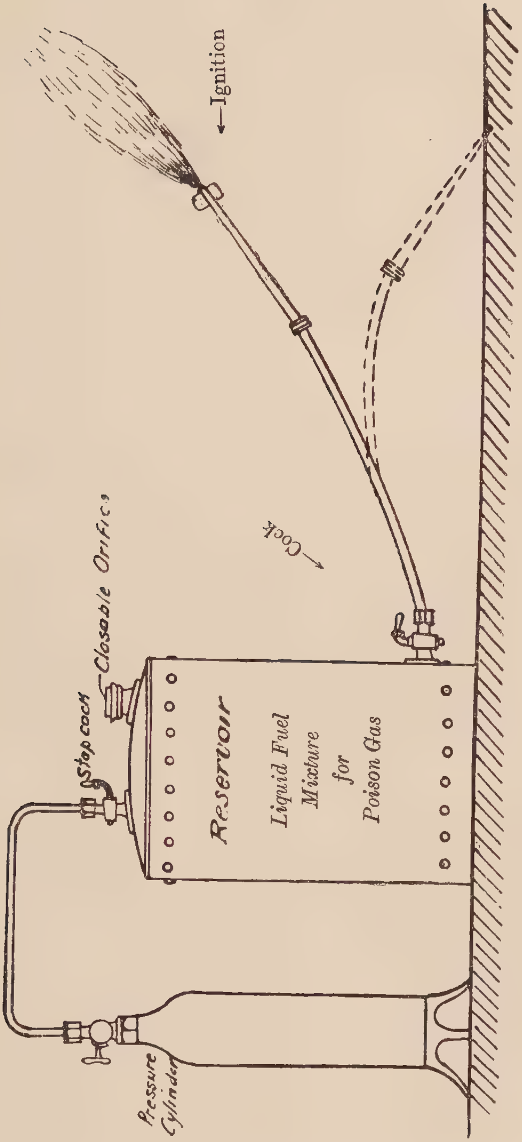


FIG. 2 The German asphyxiating-gas apparatus.

sphincters are paralysed." These symptoms he noticed in troops at a distance up to about 15 yards from the bursting point. They may be briefly ascribed as in no way due to poisoning, but to the " gas and wind " effect of the shell—its initial velocity, and the rapidity with which the projectile is fired.

It is to be noted, however, that in the siege of Liège, if not since, the Germans made use of shells of large calibre containing great quantities of sulphur.

The Poison-Gas Apparatus. In 1909 the Kaiser's delegates having suitably delivered themselves of various avowals as to their country's decision only to carry on warfare by humane methods, the military department was busy in the study of the best means available for the usage of poisonous and asphyxiating gases. Accordingly the apparatus (Fig. 2, p. 25) was made the subject of experiment, and this diabolical instrument has been adopted, in various forms in accordance with the poison produced, as a recognized weapon of civilized warfare by our adversary. When used for certain poison gases, it consists of a drum with a gas cylinder attached by means of a tube. There is a closable orifice in the drum or reservoir through which liquid fuel is inserted. To the liquid fuel is added the substance required for generation of the poisonous gas. A cock, mounted on the drum's upper cover at the end of the tube connecting the cylinder,

controls the supply of the liquid or gas under pressure, which is used to expel, with force, the poison mixture.

Sulphur was the substance first tried, producing sulphur dioxide. The German experts stated that in *their* opinion

> "this gas acts as an irritant on the lungs and eyes, and is thus adapted to incapacitate the enemy, but it is not poisonous, so that its employment in warfare is not contrary to International Law."

Near the bottom of the drum there is another cock joined to a long pipe, or hose, which may be carried underground by means of a tunnel or over the ground surface as near as possible to the trenches. The mixture, liberated by the opening of the cock, is forced from the drum through the pipe at a pressure capable of carrying it, under favourable conditions, a considerable distance, in the form of poison gas, ignition having taken place by means of an inflammable liquid contained in a small receptacle near the nozzle at the end of the tube. Various ignition devices are employed, according to the length of the tube and whether it is underground or otherwise.

Carbon-Monoxide. Reverting to the subject of carbon-monoxide, this is a colourless, tasteless gas, almost without odour, burning with a blue flame. It is produced by a number of methods,

as by the burning of charcoal (carbon) with a deficiency of atmospheric supply, and by the generation of the gas in the course of manufacture of acetone, also in the Leblanc soda process.

Cases of poisoning by this gas are of very frequent occurrence. In France a popular method of suicide is by inhalation of the fumes of charcoal. Inhalation causes paralysis, eventually, of the respiratory organs.

French and German literature contain many records of the remarkable effects produced by this poison. Poelchen cites the case of a woman who lived unconscious for two days after inhalation, but who made such a rapid recovery as to enable her "to resume work in seven days." She, however, suffered "aphasia," that is to say loss of speech. Three weeks later mental trouble developed, she became weak-minded, her articulation gradually became more and more difficult until she could no longer speak at all, and soon after she died.

A French writer of the present day ascribes some of the phenomenal cases of loss of memory, subsequent to shell fire amongst troops in the present war, to the known fact that carbon-monoxide is given off by bursting artillery shells. In 1887 Cacarrié published his "Essai sur les Amnésies Toxiques," giving examples of loss of memory resulting from exposure to this gas; and since that date the subject has been treated by several French authorities.

Ordinary, illuminating coal gas contains from 4 to 12 per cent. of carbon-monoxide, and the escape of the latter has frequently led to asphyxiation at gasworks.

The use of "geysers," in recent years, for heating bath water, has led to many cases of carbon-monoxide poisoning in England, and a far greater percentage on the Continent. The causes appear to be twofold, viz. want of ventilation in the bathroom, and defective geysers.

Chlorin. Chlorin derives its name from the Greek word meaning "green." It is a yellowish-green gaseous element, an irritant poison, with a highly suffocating odour, and being more than twice as heavy as air, if propelled by such an apparatus as that indicated, it would travel along the ground for a considerable distance. Chlorin was first made by Scheele in 1774, who termed it "dephlogisticated * marine air." In 1810 Davy confirmed the supposition that chlorin was purely an elementary body, and gave it the present name. Chlorin gas reduced to a liquid, under pressure at a very low temperature, is carried by the Germans, in strong steel cylinders, with stop-cocks, ready for use. To distribute the gas, in these cases, the stop-cock is attached by a nozzle to the tube apparatus (*see* p. 26). The removal of the pressure drives the liquid through the tube, and upon contact with the air, it becomes reconverted into gas—which is driven

* Deprived of inflammability.

by the pressure along the ground, and rolls into cavities or trenches.

"Halogen" indicates birth from salt, and chlorin is a member of the Halogen group, the remaining elements, there are altogether only four, being fluorin, bromin, and iodin. All are poisonous. Chlorin exists very largely in the deposits of Galicia, and also in the salt of Cheshire. The latter deposits are, however, dwarfed by those existing near Stassfürt in Germany, which, since the year 1879, have been under the control of a powerful German banking syndicate.

Common salt is a binary compound of chlorin and sodium, that is to say, it is chloride of sodium.

Cases of chlorin poisoning are extremely rare, and have hitherto been chiefly confined to persons employed in chemical works where the gas is utilized, or to those engaged in dealing with chloride of lime.

Following upon an exhaustive search of the records, I am only able to trace seven cases of really acute asphyxiation resulting from inhalation of chlorin.

Chlorin is not employed in medicine, other than as an antiseptic, in the form of chlorine water, which is simply water charged with a minute quantity of the gas. This preparation is occasionally taken internally, 20 drops being the maximum dose.

A child was once given in error a mixture of this chlorine water and potassium bromide, prescribed by a quack. She died in fifteen hours, however, of bromin poisoning as a result of the chemical change set up.

There are several medicinal, and chemical preparations prepared from chlorin in various forms, amongst these being chloral hydrate, invented by Liebig in 1831, and now prescribed chiefly as a hypnotic; it is also taken as an antidote for strychnine poisoning, and for attacks of tetanus. Chloroform is also prepared from a preparation of chlorin, viz. chlorinated lime.

The effect upon the troops of this and any other gas employed in warfare would, to a marked degree, be dependent upon the actual percentage of poison in the atmosphere at the moment when it reached the men. Thus the distance between the adversaries becomes one important factor, and the direction of the wind another.

At very close range, owing to the density of chlorin, one might expect to find it nearly undiluted, and this would account for the severity of the gas action in some cases as compared with others. In the event of heavy rain, the effect of the gas might be mitigated, as it is soluble in water.

Bromin. Bromin is a heavy, dark, reddish-brown liquid, owing its name to the Greek term for "bad odour." It was discovered in 1826 by Ballard of Montpellier. Bromin is volatile, giving

off a brownish-red vapour, the smell and asphyxiating effect of which are very similar to those of chlorin. In contact with the skin it produces painful sores, and also has a peculiar, irritating action upon the eyes.

Although cases of poisoning by means of chlorin have hitherto been rare, those resulting from bromin are even more so. Only about five cases are recorded by the world's principal toxicologists. Of these two were suicidal, the third accidental, the fourth resulted from the prescription of a shoemaker, practising as a quack, and the fifth from inhalation of bromin vapour.

Bromin itself has no medicinal use, but a large number of highly valued pharmaceutical preparations are manufactured from it. Bromide of magnesia, for instance, contains 54·9 per cent. of bromin. Most of these medicinal preparations are sedative in action.

A condition of poisoning by bromin, or its compounds, is termed "bromism." A person having taken excessive quantities of medicinal preparations of bromin, is said to be bromized. The symptoms are chiefly an eruption upon the face and body, sometimes called "bromide rash," accompanied by drowsiness and headache.

Germany at one time controlled almost the world's market in both chlorin and bromin, owing to the huge supplies obtainable from the Stassfürt potash deposits, but in recent years American salt has become a factor in the reduction of the

price of bromin to about one-eightieth of that at which it formerly stood. Germany in consequence is estimated to have had on hand huge stocks at the outbreak of hostilities.

The two important producers of chlorin and bromin in Germany are the Badische Anilin und Soda Fabrik, of Ludwigshafen on the Rhine, and the Chemische Fabrik Griesheim Elektron of Frankfürt-on-Main.

Even prior to the declaration of war the staffs of these establishments had undergone enormous increase, in spite of the fact that the prevailing normal trade conditions did not warrant the change. At the present time the number of employés is said to have been more than doubled. No tangible reason has ever been given by the authorities for the adoption of these steps.

Bromin is a product at Stassfürt from the mother liquor of the German potash deposits, which contain about 0·25 per cent.

Sulphur Dioxide. A ready and very inexpensive means of poisoning the Allied forces is found in the employment of sulphur dioxide. This is a highly poisonous, asphyxiating gas produced by the burning of sulphur with any suitable combustible agent at hand. It is, when pure, transparent and colourless, with a pungent odour, and causes great irritation to the eyes, lungs, and air passages, setting up bronchitis in an acute form, owing to its corrosive properties, and destroying everything within its reach.

Troops engaged in the projection of this gas upon a large scale would doubtless be provided with smoke helmets (*see* pp. 42 and 43).

Many deaths have resulted from asphyxiation by this gas in Bohemia, where the manufacture of sulphuric acid is largely carried on.

A solution containing 5 to 6 per cent. of this gas is used medicinally, under the name of sulphurous acid, chiefly as a prophylactic (preventive of disease), the dose being from 30 to 60 drops. It is also used as an antiseptic.

Naval Poison-Gas Machine. The recent intelligence, as to the usage of poison gas by the Germans in land warfare, has created a profound impression, but the fact that they intend to utilize poisonous asphyxiating gases in *naval* engagements will be unknown to the general public.

Long ere this conflict, I gathered from the candid confession of a German engineer, that England would one day be the recipient of a surprise in the shape of a poisonous air wave upon German invasion of her shores, facilitating, in his opinion, an extensive landing of the Kaiser's troops. This plan may, or may not, be considered feasible, nevertheless, the idea that the Germans may seek to repel attacks of landing parties, and small craft, in sheltered waters, by such methods, is by no means to be lightly dismissed.

Certain German experts, in 1910, had under serious consideration the adoption of an engine

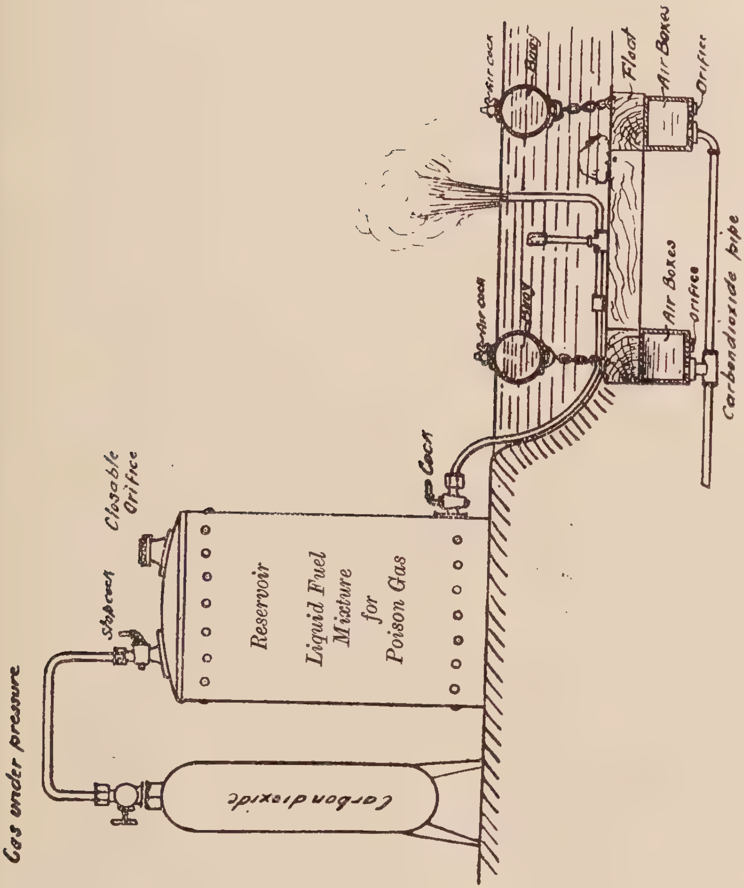


FIG. 3. The German naval poison-gas machine

of naval warfare, such as I describe in Fig. 3, p. 35, and I have reason to believe that, since this date, very important improvements have been effected in its design.

The machine provides, in the main, for the sudden emission, at great pressure, of large quantities of poisonous gas from the surface of the water. A salient feature is the fact that there is nothing of consequence visible of the machine, or pipe, above water. A sudden rush of poisonous vapour only, tells its tale upon the approach of the launches, and tow-boats of battleships. The apparatus consists essentially of a cylinder containing gas under pressure, connected with a reservoir filled with oil fuel, to which has been added the poisonous substance used for generating the gas. The reservoir (or batteries of the same) is hidden away in a convenient spot. A long pipe is attached, similar to that described in Fig. 2, p. 25, with the exception that the capacity is much greater and the construction more powerful. This pipe passes by a land-tunnel under water. The poison mixture traverses by means of the pipe, and ascends according to its density in comparison with air, the nozzle being only just covered by water, or preferably protruding an inch or two. To accomplish this, oil fuel is employed—this being lighter than water and insoluble in the same. The poisonous gas generated would thus also have to conform with these latter require-

ments, unless the nozzle protruded. Upon ignition and the application of pressure, by means of the cock on the reservoir, the gas develops with great force. When the nozzle protrudes, ignition takes place by means of the detonation of a primer, connected with the apparatus by a separate pipe bound to the first mentioned. The primer, which is protected from water by a thin casing of india-rubber, ignites an inflammable and insoluble liquid contained in a small receptacle attached, thus generating the poison gas.

In order to retain the pipe under water, and to keep the nozzle, through which the poison gas is given off, just below, or at the surface, the pipe is attached, at intervals, to floats which are weighted. The floats are kept below the surface by means of buoys attached thereto. The buoys are spherical, hollow, and provided with air cocks, by the regulation of which only such portion of the buoys would protrude above the water as to be scarcely discernible. The framework is brought speedily to the surface, and once more lowered by means of the boxes underneath.

These boxes are connected with a second pipe underneath all, which leads to the big reservoir's compressor. When it is required to raise the frame, the boxes thus connected are charged with carbon-dioxide by means of the lower pipe. The water is thus expelled from the boxes through the orifices, causing the frame to ascend. In

order to lower again, the carbon-dioxide is allowed to escape, and the water to re-enter.

It will be seen that, unless the nozzle giving off the asphyxiating gas is allowed to protrude a few inches above the water surface, chlorin could not be utilized, owing to its solubility. Bromin, forced through a little water, would lose a considerable percentage of its toxic qualities, in addition to there being other disadvantages in its employment.

Sulphur dioxide (*see* p. 33) would be easy to generate and might be more readily employed, with the nozzle at, or in close proximity to, the surface.

Experiments were conducted with the object of driving the fuel mixture through water, thus obviating the protrusion of the nozzle. The theory was that the fuel mixed with the poisonous substance would form an inflammable layer on the water, and that this was capable of ignition by the employment of a water-protected device, connected with the apparatus by means of a separate pipe and containing phosphide of calcium. Upon the application of pressure through the pipe, the protecting cover of the phosphide bursts, causing the latter to rise to the surface, whereupon the phosphide decomposes the water, and ignites the gases given off by the decomposition, thus generating the poison fumes.

Blowing up the Enemy. Many cases of asphyxia occurred during the Balkan War, as a

result of "blowing up the enemy," although it is doubtless a fact that the majority of these might have been avoided had the troops been equipped with the necessary remedial and preventive appliances, or had they adopted other precautions. The explosives in general use for this purpose (*see* p. 100) give off asphyxiating gases. Gun-cotton has been known to produce from 27 to 40 per cent. of carbon-monoxide, upon detonation. About fifteen minutes after explosion as much as 0·13 per cent has been present in the air. Troops advancing too rapidly over a short range of ground, subsequent to such explosions, may expose themselves to considerable risks, for the gas is wont to collect under heaps of debris and rock, and is instantly liberated, even hours after the explosion, by the removal of such obstructions.

An announcement will read, "We successfully exploded a mine, blowing up one of the enemy positions to-day." There are few of the uninitiated outside public, who from this laconic intelligence, would be capable of realizing what the undertaking may have involved to those who actually effected it.

It is indeed difficult to over-estimate the heroism and self-sacrifice of officers and men alike, engaged in these operations during the present war.

Another explosive much in use for blasting is GELATINE DYNAMITE. This emits a much lower percentage of carbon-monoxide gas, but should it

fail to explode and burn away, large quantities of nitrous fumes, in addition to the other gas mentioned, may be given off.

In fact, it not infrequently occurs that the attempt to "blow up the enemy" fails, owing primarily to one of the following causes, viz. imperfect detonation, the explosive charge burning away; or the detonator may become detached from the explosive, and the latter fail to explode; or there may be only a partial or a premature explosion.

These results may be produced, either by the deterioration, or bad quality of the explosive—its having been improperly stored, the dampness or weakness of the detonator, or similar causes; but upon all such occasions there is serious danger of asphyxia involved to those within reach of the gas.

When nitro-glycerine explosives are employed for blasting purposes, acrolein and prussic acid also are given off. Acrolein is a volatile oily liquid, highly poisonous, formed by decomposition of the glycerol.

Pulmotor. In cases of asphyxiation, where oxygen is the antidote, the portable pulmotor is utilized. This is a very cleverly designed apparatus, and the type shown (Fig. 4) is that devised by the German Draeger Company, of Lübeck (near Hamburg). It operates by forcing oxygen into the lungs, and drawing out the air. The German inventors recommend its usage,

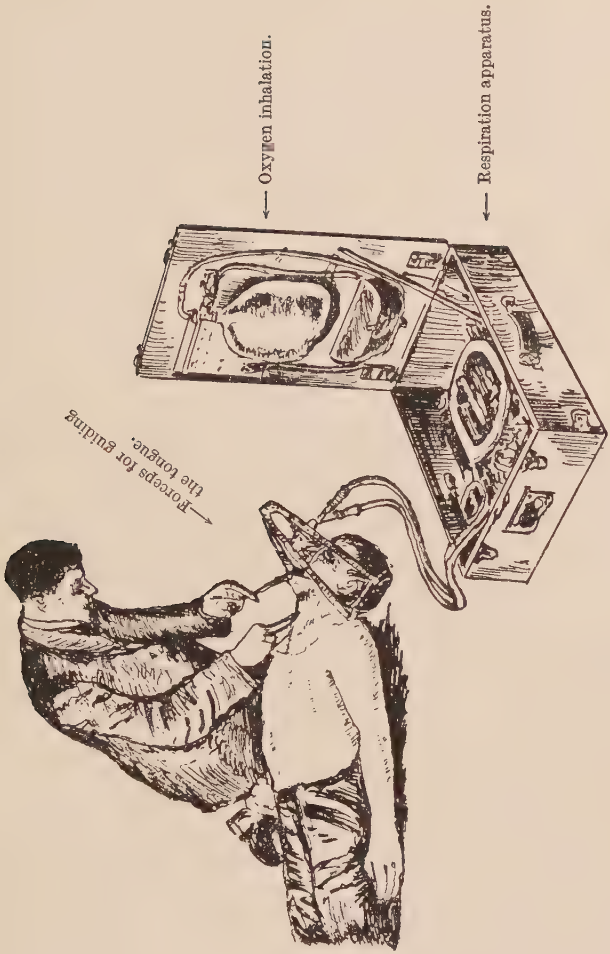


FIG. 4. The pulmotor.

"in cases of asphyxiation by noxious gases." Oxygen is contained in a cylinder (the capacity of which is about $11\frac{1}{2}$ cubic ft. of gas) and this is fitted with a pressure-controlling valve.

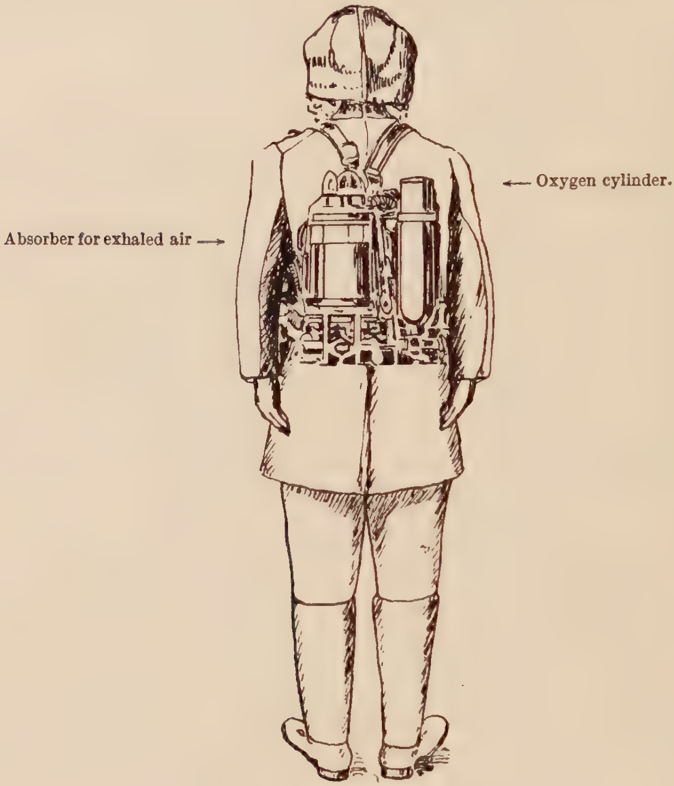


Fig. 4a. The oxygen helmet.

The oxygen travels from the valve to an injector, which draws in air by means of suction, and likewise sends it forward, by means of a tube in front of the injector.

Thus the lungs are alternately filled by pressure and emptied by suction.

The Germans, to the fore in the study and

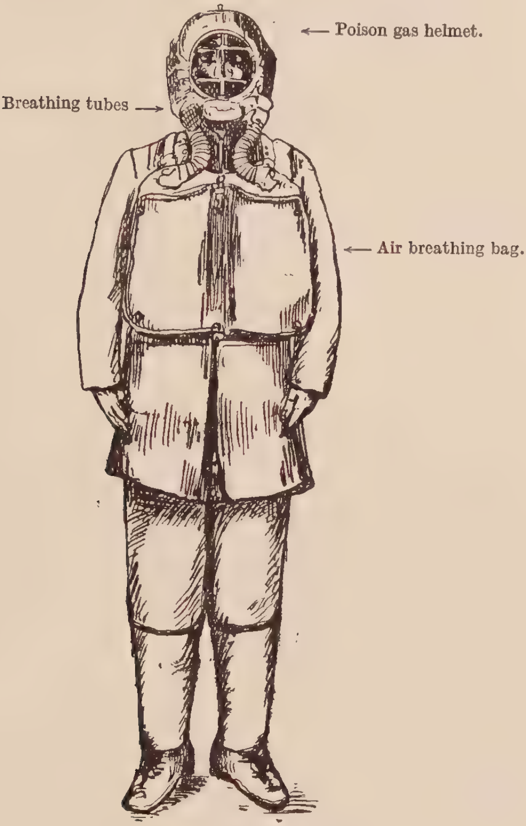


FIG. 4B. The oxygen helmet.

usage of noxious gases, have adopted the precaution of equipping many of their regiments with protection or rescue apparatus. Whenever there is a leakage in the reservoir of poisonous gas,

the officers and men undertaking the repairs don oxygen helmets (Figs. 4A and 4B), and are thus independent of the toxic atmosphere, the entrance of which is prevented.

The four chief varieties of these instruments of safety are known as the "Esseff," the "Fleuss," the "Weg," and the "Draeger." They are all light and portable, the main feature being a supply of compressed oxygen, which, carried in small cylinders, is strapped to the soldier's back, his head being protected by a helmet similar to that worn in coal-mines.

There is a breathing bag, or reservoir of air, affording a continuous supply during usage by the wearer.

The amount of oxygen contained in the cylinder is calculated upon the basis that a man at rest consumes 0·3 litres per minute, and when at work, according to the nature of his task, up to 2 litres per minute, an ample margin being allowed.

Bombs and Grenades. The present Chinese term for firearms is "huo-p'au." In ancient times this term represented a machine or frog-gun called "huo-p'au," which was used for firing poisonous or incendiary compositions at an enemy at short range. Translated from the Cantonese, "huo" and "pao" indicate, in reference to this subject, a dirty "stink-pot" fire machine. There appears to be considerable diversity of opinion as to the nature of the original "stink-

pot," probably owing to the traditional unreliability of early Celestial chroniclers.

The origin of such weapons, it may be explained, is of great antiquity. They are referred to as having been in use, in various forms, since the year 904 (at the siege of Salonika). Pitch balls, composed of pitch, oil and fat, were reported by William of Tyne to have been exclusively used at the siege of Nice.

In 1560 Whitehorne referred to "earthern bottles," as having been utilized for hand-grenades. He gives a recipe as follows: "hollow balles of metal, as big as smal boules and $\frac{1}{4}$ in. thick, cast in mouldes and made of 3 partes of brasse and 1 of tinne." Further he states that they should be loaded with "3 partes serpentine, 3 partes fine corne powder and 1 part rosen." He suggests that, as they will "breake and flye into a thousand pieces," they should be quickly handled.

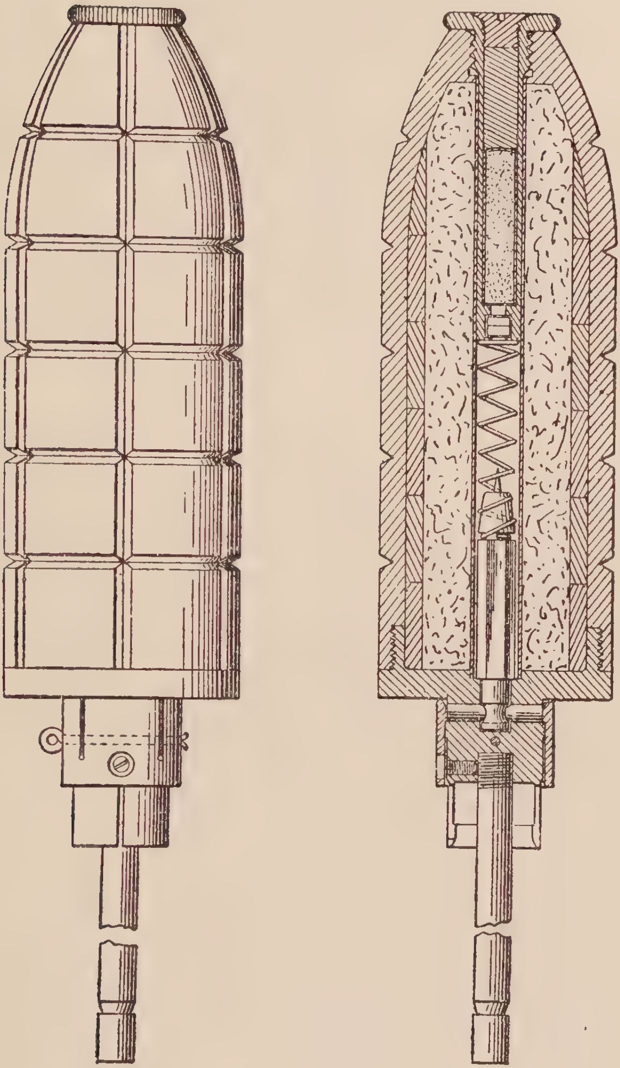
In Evelyn's "Diary" we find that on June 29, 1768, he saw, at the Hounslow Camp, certain soldiers called "Grenadiers" who were dexterous in flinging "hand-grenades." This weapon of defence was not much in vogue during the Napoleonic era, but in 1885 it came once more into prominence, being favoured by the English against Soudanese tribes—and the advent of the Russo-Japanese campaign found the hand-grenade nearly as important an adjunct of infantry equipment as the rifle. A modern hand-

grenade, or bomb (when not especially filled with poison by Germans), is spherical in shape, and contains picric acid, T.N.T., tolite, gun-cotton, or any suitable explosive. The general weight is about a pound. As to its action, unless the explosive radius is limited, there is considerable danger to the thrower. The Germans endeavoured to utilize heavy-weight grenades in the present war, only to find themselves once again hoisted with their own petard. For it was found that the weapon being so heavy was incapable of being thrown to a sufficient distance, in order to enable the thrower to escape the increased danger zone. The numerous accidents to German infantry opposing the trench battle-fronts with these weapons are due to this cause.

Effect of Grenades. Colonel W. G. Macpherson, R.A.M.C., in his report (1908) states: "They caused wounds which were difficult to treat satisfactorily. . . . They were usually multiple, and in some they were not only caused by strips of the metal case but by the explosive effects of the pyroxilin gas, which appears to have been the explosive agent. . . . The explosive effects were, as a rule, those of complete shattering of a limb. The wounds were also, at first, of a brilliant yellow colour."

Pyroxilin gas is given off by gun-cotton, which was then, and is now, the explosive agent much used for grenades.

The Teutonic poison grenade, instead of being



Grenade Showing striker

FIG. 5. Apparatus for throwing a grenade from a rifle, instead of by hand (Hale's patent).

filled with ordinary explosive, is charged with chlorin, nitric-peroxide, or other gas. The tube of the Poison gas machine (Fig. 2, p. 25) has a special nozzle which can readily be adapted for charging bombs on the field.

The Germans, in the present conflict, have sometimes utilized an apparatus for hurling grenades, from the ends of sticks, to which they are attached by means of a simple device, which permits of their prompt liberation. These instruments have also proved, from time to time, a source of danger to the throwers. One of the most important innovations in the matter of grenades was that evolved by Hale, an English engineer, in 1911 (Fig. 5, p. 47). This consists of safety devices for the firing of shrapnel or other grenades from the ends of ordinary rifles, by means of which the missiles may be carried upwards of 200 yards. The invention provides safety for the user, inasmuch as the "striker" is so arranged that the projectile will not explode by accidental falling. There is a rod in the rifle barrel and firing takes place by means of a rifle cartridge minus the bullet.

ARTICLE II

THE ALLIED TROOPS BEING SYSTEMATICALLY POISONED BY THE GERMANS IN A MANNER PUBLICLY UNKNOWN : THE HAGUE CONVENTION AND THE USAGE OF POISON IN WARFARE : THE ROMANS AND THE GERMANS : CASES OF THE POISONING : ITS SUBTLE METHOD OF ADMINISTRATION

In the preceding article I dealt with a subject publicly known, namely the visible, poisonous asphyxiation of the Allied Forces by the Germans. This is a method of barbarism only recently adopted by the enemy, and clearly contravening Clause 23 (E) of The Hague Convention, which states that a belligerent may not employ material causing unnecessary pain or suffering to an enemy. I now propose to explain how the Germans have been and are carrying on the systematic, *invisible* poisoning of the Allied Forces at *long range* in a manner hitherto generally unknown.

Thus does the enemy cast to the winds the laws of civilized warfare, and The Hague Convention, Clause 22, also 23 (A),* (forbidding the employment of poisoned arms). The most casual of critics cannot fail to note the vast difference between the occasional use, at short range, of

* *See* Appendix I, p. 127.

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poisonous gases and hand-grenades, and the general usage by an enemy of poisoned long-range projectiles.

In order clearly to state the position I may say that the German Military Authorities deliberately poison the Allied troops by the employment of a most dangerous, irritant poison, in the composition of their artillery projectiles, from the "77" shell upwards, namely, *white or crystalline phosphorus.* Also they are now manufacturing ordinary rifle cartridges containing a percentage of the same poison.

If their intention had been to produce luminous shells, that end might well have been accomplished without the introduction of poisonous matter.

It is within my knowledge that German chemists made experiments with harmless ingredients, but that these were discarded by experts in favour of the toxic composition described upon p. 65, and that in the selection of this toxic or poisonous compound, the said experts must have had in view the insidious and deceptive nature of its action upon the human body, thereby rendering it extremely probable that such cases of poisoning would either be mistaken for symptoms common to wounds in warfare, or pass unnoticed.

I am informed by reliable experts that such cases of poisoning actually have been mistaken for effects due to other causes.

The real questions at issue may be summarized as follows:

(1) What evidence is there to show that the German artillery did and does use such poison as a weapon against the Allied Forces?

(2) The poison, if any, so used and the nature thereof?

(3) The mode of its employment?

(4) The manner in which the poison referred to destroys life or causes serious injury?

(5) The toxicity, or the lethal dose, necessary for this purpose. Or, in other words, could the substance used cause injury or death?

One of the most eminent toxicologists, Dr. Swaine Taylor, stated as follows: "A poison is a substance which when absorbed into the blood is capable of seriously affecting health or of destroying life."

To quote Emerson on Legal Medicine: "Evidence in cases of poisoning is derived from several facts. For example:

"The symptoms,
Post-mortem appearances,
Chemical analysis,
Experiments upon animals.

"In addition to these we have the so-called moral evidence which may be apparent to others besides physicians—who are immediately connected. The chemist may testify as to the action of the poisons upon the human system, though he may not be a physician."

It has been frequently stated of The Hague Conferences, that in reality they consisted of assemblies of delegates, each present with the paramount intention of safeguarding his nation's interests, these being, as a rule, widely divergent from those of other nations represented. It has also been stated that the phrases of many of the clauses are elastic and not applicable to the new situation. This perhaps may be correctly said of the regulations respecting the use of contact mines * and of asphyxiating shells † in warfare, but in no sense can such reference be made to apply to the usage of poison in warfare.

In arriving at the regulations concerning poison in warfare, the Articles of the revised Declaration of Brussels were accepted (with slight modification), as a Text, Articles 22, 23, and 23 (E) ‡, corresponding almost exactly with those of 12, 13, and 14 of the Declaration of Brussels.

It must, however, be borne in mind that in the drawing up, and adoption of these Articles, the delegates were bound by time-honoured custom.

The Romans forbade the use of poison in warfare. The fact is commented upon by Grotius (1625) and by other jurists of note.

It is interesting also to observe that the Romans often confounded the " Law of Nations " with the " Law of Nature," calling the " Law of

* *See* Appendix IV, p. 134. † *See* Appendix III, p. 131.
‡ *See* Appendix I, p. 127.

Nations" (*jus gentium*) the "Law of Nature," as being "generally adopted by all polite nations."

Tiberius, in spite of the unnatural vices in civil life, with which he has been accredited, scorned the use of poison in warfare, and rejected the proposals made by the Prince of Catti that he should utilize poison in warfare, against Arminius. Tiberius did not think that poison should be made use of, even by way of reprisal, although his troops were at the moment outnumbered, and hard pressed.

The Consuls Caius Fabricius, and Æmilius rejected with horror the proposal of Pyrrhus' physician to poison . . . haughtily adding, "it is not to make our court to you that we give this information, but that we may not draw on ourselves any infamy"; and in the same letter adding, "that it is for the common interest of all nations not to set such an example."

It was a maxim of the Roman Senate, that war was to be carried on by arms and not by poison: "Armis belli, non Venenis, geri debere."

Jurists of the eighteenth century were emphatic as to the abuse of the customs of warfare by the usage of poison. De Vattel (1793) gives his opinion on the equivalent of Article 22 of the Regulations annexed to The Hague Convention (*see* Appendices), which treats of the right, or unlimited right, to injure the enemy. "The most effectual, the most proper methods may be chosen, provided they *have nothing odious*."

Concerning the right "to employ poisoned arms, poison, or kill treacherously" (Article 22 of The Hague Regulations *), De Vattel asks, "whether all sorts of means may be employed to take away an enemy's life? Whether he may be assassinated or poisoned?"

"Pepin, father of Charlemagne, having passed the Rhine with one of his guards, went and killed his enemy in his chamber, and should a resolute soldier in the night steal into the enemy's camp, get to the general's tent and stab him, in this there is nothing contrary to the natural laws of war. But in order to dismiss this question with solidity, assassination is by all means to be distinguishable from surprises, which in war are doubtless very allowable."

"Nations may do themselves justice sword in hand . . . but shall it be indifferent to human society that they employ *odious means?* . . . Thus, whoever by his example contributes to the introducing so destructive a custom, declares himself the enemy of mankind and deserves the execration of all ages." †

"A *treacherous poisoning* has something more odious even than assassination; the effect would be more inevitable, and the use more terrible; accordingly *it has been generally detested.*"

Concerning the employment of "projectiles

* *See* Appendix I, p. 127.

† Dialogue between Julius Cæsar and Cicero.

causing unnecessary suffering," * the same authority states : " This use is not the less interdicted by the law of nature, which does not allow us to multiply the evils of war."

" It is therefore with reason, and agreeable to their duty, that civilized nations have classed among the laws of war the maxim which probably *prohibits the poisoning of arms*, and all are warranted by their common safety to suppress and punish the first who should offer to break through this law." †

The reference by De Vattel to Charlemagne and poison recalls the fact that no less than nine of that monarch's successors, as Emperors of the Holy Roman Empire, prior to the advent of the Austrian rule in 1438, succumbed to the effects of the " more gentle operation of poison." Of the Popes of Rome down to 1471, five are said to have met with similar deaths.

The writings of these ages seem to show that poisoning was *à la mode* as a weapon of political murder, or vengeance, but that its usage in warfare was discountenanced to a marked degree.

The Romans had a superstition that the bodies of those whose death was due to poison offered a much greater resistance to fire than those of persons who died from natural causes. According

* Hague Convention Article 23 (E) Appendix I, p. 127.

† The quotations from De Vattel are abstracted from a translation, dated 1793, in the author's possession, of " Droit des Gens, ou Principes de la Loi Naturelle " (1758).

to "Secrets d'Etat de Venise," published in St. Petersburg (1884), political murder by poison was counted a legitimate method of procedure.

The political poison craze was also very much in vogue in England about the sixteenth century. The Statute, 22 Henry VIII, c. 9, date 1531, ordered "poisoners to be boiled to death."

Froude records that in 1537 precautions became necessary for the safety of Edward Prince of Wales. "The food supplied for the child's use was to be largely assayed."

The German laws do not appear to err on the side of undue severity in the matter of poisoning.

Translation of the German Law

Sec. 212. He who intentionally kills a human being, if the killing has been without premeditation, is guilty of "Todtschlag," punishable by not more than five years' imprisonment.

Sec. 229. Whosoever shall administer to another, for the purpose of injuring his health, poison or other substances capable of destroying the health, shall be punished with imprisonment for a term of ten years or less. If a severe bodily injury has been caused, the imprisonment shall be for not less than five years, and when death has been caused it shall be for not less than ten years or for life.

In recent times Colonel Stevenson records that in the Boer War it was supposed that the Boers used poisoned bullets, and that "no little

sensation " was caused by the finding of a great number of bullets in the possession of the Boers covered with a green wax. Subsequently, however, it was found that the substance with which the bullets were covered was merely paraffin, used with the object of reducing wear and tear of the rifle barrel. The wax had become stained with verdigris, and the green colour was thus accounted for.

When in France during November last I had been informed that the Germans were making use of an explosive possessing certain novel characteristics upon explosion, and was asked whether I could throw any light upon the subject of its composition.

I believe the earliest reference to this subject to be contained in "Eye-Witness" report, published as follows:

"GERMAN GUNS

"CHARACTERISTICS OF THE WOOLLY BEAR

"Following is a continuation of a dispatch received this afternoon from 'Eye-Witness.'

"On some parts of our front it has been noticed that the Germans are firing a new type of high-explosive shell, its visible characteristic being that it detonates with a cloud of thick white smoke."

The white smoke referred to, upon the explosion of German shells, is caused by the union of

phosphoric and phosphorus acids with the oxygen of the air.

Our leading journals have contained references, in reports from their Special Correspondents, to the firing by the German artillerists of " luminous shells " in the present war. As to the Russian front, the most noticeable description which I have chanced to peruse is that of a Special Correspondent at Warsaw, reporting an interview of consequence with Prince Woronisky of the Red Cross Society, just subsequent to the battle of Warsaw in February last, as follows :

" Our work," he continued, " has been hampered by the latest German devilry—treating their explosives with a preparation which poisons the wound and leaves an acrid smell. The scene at the wayside station of Bednary was terrible."

The following telegram also recently appeared in the Press :

" NORTH OF WARSAW

" MASSED ATTACK REACHES RUSSIAN DEFENCES

" PETROGRAD, *Sunday.*

" The Germans used guns firing new shells, which illuminated the battlefield.—Press Association War Special."

A French surgeon from the front assured me in February last, that symptoms, *now recognized* as those of phosphor poisoning, had been most

prevalent amongst those of their men who had been wounded by shrapnel and common shell fire. These symptoms were *attributed unsuspectingly* to various other causes.

Reference to any of the leading works upon wounds in warfare shows that the absence of hygienic surroundings has always been an influence in the consideration as to the reasons for the appearance of septicæmia in the wounds of warfare.

It is therefore not surprising to find anaërobic conditions,* caused in reality by phosphor poisoning, set down as due to soil and surroundings. These conditions, when not set up by phosphor poisoning, appear to be caused by anaërobic micro-organisms found in the soil. The presence of these germs is said to be due to the intense cultivation of the lands in France and Belgium—the lands teeming with anaërobic organisms.

On January 6, 1915, Surgeon Figuiera reported, in a paper read to La Société de Chirurgie, upon the case of a wounded French soldier who had died from the effects of violent phosphor poisoning. The soldier was wounded in the arm by the explosion of a German shell. The chief symptoms were those of phosphorescence of the wound. The sufferer lingered for several days, and apparently the longer he lingered the greater became his agonies, until death relieved him on the seventh day.

* Anaërobes are microbes thriving without access to air.

Monsieur Victor Henri, the energetic Sous-Directeur of the Physiological Department of the Paris Sorbonne, communicated to the Paris Biological Society, on January 23, 1915, the result of exhaustive researches made by him, with the assistance of M. Urbain, as to the effects produced upon the wounded by the usage of phosphorus in German shells.

A quantity of German ammunition had been captured at the battle of the Marne, and at Vincennes. Some of the shells thus captured were forwarded to Paris, and were submitted to chemical examination by M. Urbain, both common shell, and shrapnel, with the result that the shells were found to contain considerable quantities of poison in the form of phosphorus.

M. Urbain states that "both the common '77' German shells and the shrapnel of the same calibre contain for the most part a great quantity of a violet-brown powder, smelling strongly of *white phosphorus*."

Monsieur Victor Henri states that "The majority of the German shells contain a reddish to violet-brown powder smelling strongly of *white phosphorus* and containing up to 97 per cent. of phosphorus."

Credit is due to Monsieur Victor Henri, for the able manner in which he conducted these researches. As a result of his investigations, M. Henri sets forth in the report of January 23, that "In some cases, when the shell explodes,

either the phosphorus does not take fire, and the poison is carried into the wound, in its existing condition, or the phosphorus takes fire, and enters into the wound in a form highly poisonous."

He explained how he introduced into the muscles of guinea-pigs, by way of experiment, shrapnel bullets taken from the poison box of a "77" German shell.

In the cases where phosphorus on the bullets had not been ignited, poison symptoms developed slowly. When the bullets were ignited prior to insertion, the symptoms rapidly developed.

Three of the animals experimented upon died of phosphor poisoning, on the fifth and sixth day following; a fourth succumbed after several days, having in the interim suffered the loss of about one-sixth of its weight.

A post-mortem examination was conducted by M. Faure-Fremiet and showed "fatty degeneration of the liver in a marked degree."

It may be added that this is a common accompaniment of phosphor poisoning.

M. Henri states that seeing that the quantity of phosphorus thus introduced into wounds derived from German shell fire is variable, the introduction of even the smallest particles of the poison is likely to produce gangrene and other serious consequences to the wounded soldier.

On January 11, 1915, Professor Dastre communicated to the Académie des Sciences the result of the researches made by M. Victor Henri,

his Sous-Directeur—the essence of which I have already given.

The avowed object of the use of this poison is of course LUMINOSITY—or in other words, to ascertain the range of the enemy's position.

This being the case, why, one may ask, have our adversaries deemed it necessary to fire innumerable phosphor shells during broad daylight ?

Do they advance the theory that the smoke given forth by the range-finding common shell is invisible at a distance suitable for the purpose ?

Be this as it may, I am credibly informed that German chemists, in a certain Rhenish factory, were very busy at one time in the evolution of a material for luminous shells—in the composition of which material a poison played no part.

Given the military necessity for the firing of luminous shells in battle, that poisonous compounds should form an ingredient thereof, is wholly unnecessary. Judging from the nature of experiments carried out in Germany with other, and non-poisonous chemicals, also the fact that with these an effect as good, if not superior, to the phosphor light is produced upon explosion, one is drawn to the conclusion that there is and has been a deliberate attempt to poison. Readers seeking further evidence in support of this conclusion need only to peruse the subsequent pages of this book.

The Method of Administration. The method of introduction of the poison in the case of shrapnel shell is particularly diabolical. It may be briefly described as follows :

The projectiles I examined were of the German

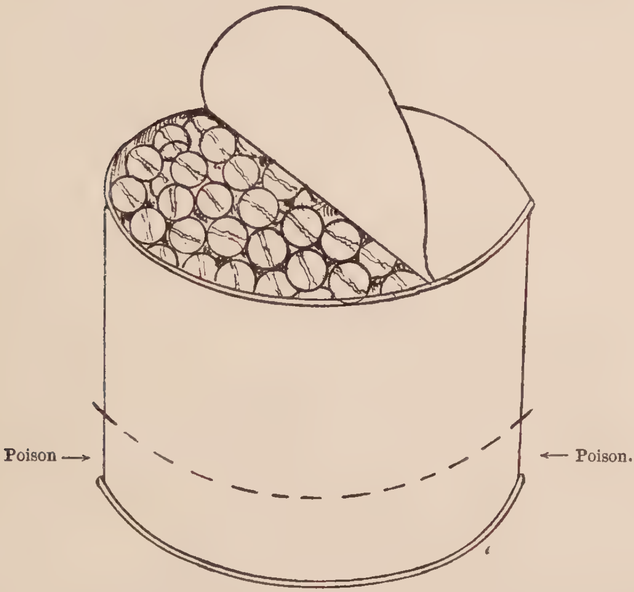

FIG. 6. Perspective view. Top partly open and lid bent back.

"77" pattern. The shell cases contained round metal boxes of a diameter of 65 mm. (*see* Fig. 6 above).

At the base of each box was a quantity of violet to reddish-brown powder ; and on top of the powder the bullets were closely packed.

The shrapnel bullets, of 1 cm. diameter (Figs. 7 and 8) and weighing each about 10 grm.

(154 grains), were especially holed and dented instead of presenting the ordinary smooth surface.

These bullets had obviously been agitated and compressed with the reddish powder in order to make their fiendish object more assured. Upon explosion the bullets would take up a certain amount of the adhesive powder from the

Fig. 7. The normal shrapnel bullet.

Fig. 8. The shrapnel bullet poisoned.

base of the box, in addition to that already contained in the dents and holes mentioned.

The explosive in these particular instances, was " tolite " (*see* p. 93). None of this was contained in the aforementioned box, but in a glass tube inserted in the shell case.

The common shell contained a cylindrical metal case about 2·37 in. in length and 09·8 in. in diameter (Fig. 1, p. 12).

This cylindrical case was inserted in the glass tube, a hollow in the tube having been especially constructed to receive the metal case. Those glass tubes which I have had the opportunity of examining were filled with 96 grammes of compressed " tolite." The tubes were those contained in the " 77 " German shell, which is analogous to the French " 75 " and our 3-in. Thus the poison was surrounded by the explosive,

and its distribution assured, for the cylindrical metal case referred to contained, in a strongly compressed form, the violet-brown powder previously mentioned.

M. Urbain's analysis of the powder disclosed an average of 97 per cent. of phosphorus in two varieties, viz. *amorphous phosphorus* * and *white phosphorus*. The quantities of each varied considerably, but the white phosphorus present (being in combination with the red), was always sufficient to constitute a highly poisonous element in wounds.

The outer case of the "77" shell bore the following marks :

Rh.† M.P. 77
Tan. O 1911
Düsseldorf.

The poison tube or case contained in the tolite tube, Fig. 1, bore no mark, but the tolite tube bore the following inscription :

Sprengladung ‡ E.F.
96 Grammes L. 77
Hanau 1911.

* Having no definite form.

† "Rh.," when not a contraction for Rhein, is probably one of the German military marks designating the particular explosive contents. A large number of these cases bear the military code mark "R.G." (tubular powder used in German field guns). "M.P." probably stands for field-gun ring powder.

‡ Sprengladung, or Sprengmunition, is the German synonym for tolite-explosive. (*See* p. 93.)

Hanau is a Prussian town, of about 30,000 population, situate fourteen miles from Frankfort, thus being conveniently near the phosphor factories. In Hanau there are extensive engineering works, and doubtless to one of these the poison tubes were dispatched from Frankfort, to be fitted into their receptacles.

The 77 cm. guns firing these poisonous projectiles bear the distinctive arms of the Teutonic kingdom to which they belong. The arms of Prussia, Saxony, Bavaria, and Würtemburg are all separately represented.

Over each or any of these arms is inscribed the motto, "PRO GLORIA ET PATRIA." Above the breech is the Imperial Crown, accompanied by the monogram of the Kaiser, completed by the significant inscription, "Ultima Ratio Regis."

About 300 shrapnel bullets are contained in each of the German shells.

In spite of the fact that the shrapnel bullets of the French "75" shell weigh 185 grains, whereas those used in the German "77" shell weigh only 154 grains, the initial velocity of the German shrapnel bullet, fired from the "77" gun, is by no means equal to that of the French "75."

The shrapnel shell of the German field-howitzer carries 500 bullets.

The position of the explosive charge in the shell has an important bearing upon the effect and velocity of the shrapnel. For example, in the

French shells it is generally mixed with the bullets. This would have the effect of increasing the power of the shrapnel.

The Austrians, as a rule, place the charge behind the bullets, thereby imparting greater force thereto. In the German shells which I have seen the charge is placed in front, thus producing a lower initial velocity, but much greater scattering power. It may be added that in the event of poison forming a portion of a shell's contents, low velocity renders the poison easier of distribution, and its effect more dangerous to the troops. On the Russian front, in particular, the Germans have used guns of large calibre, firing shells containing this poison. These projectiles have the characteristics of both the common and the shrapnel shell combined, and are remarkably destructive, for they throw both bullets and fragments, and each, although not all, may convey the poison.

In the case of these shells, the explosive charge is placed behind the shrapnel bullets, and there is an ignition tube which serves to explode the charge. In the centre there are loose shrapnel bullets mixed with powder, and in front a powerful charge of high explosive.*

Upon explosion of a common shell, air resistance materially decreases the velocity of the fragments, and owing to the weight of a shrapnel bullet, and to the fact that its shape is

* *See* Fig. 10, p. 119.

spherical, its velocity would not be anything like that of the modern bullet discharged from a rifle.

The power of penetration, therefore, of the fragment, and of the shrapnel bullet, is generally less than that of the rifle bullet.

Statistics conclusively prove that wounds which owe their origin to shrapnel bullets are as a rule not so pernicious as those due to rifle bullets.

Given normal conditions, a man struck by a shrapnel bullet at low velocity and in a non-vital part of the body, will recover. Under the abnormal conditions imposed by the German poisoned shrapnel bullet, he will, generally, make a *pretence* of recovery—even so far, perhaps, as to be sent away on leave—having merely exhibited symptoms of such a minor character as to pass unnoticed. Stealthy and serpent-like as is this poison in burning, so is it in its toxicological action upon the human body.

In a number of experiments which I made with shrapnel bullets extracted from such boxes, the average duration of the phosphorus in burning was about ninety-five seconds.

ARTICLE III

THE GERMAN LONG-RANGE POISON : ITS HISTORY : NATURE AND EFFECT

From the foregoing it will have been perceived that the poison employed is phosphorus.

Phosphorus owes its origin to Germany, having been first discovered by Von Brandt in the year 1669. This alchemist, however, succeeded for some time in keeping the discovery secret.

Kunkel, a celebrated scientist of the period, assisted by no less a personage than Frederick William the Great Elector of Prussia, first published its method of preparation in 1678.

The scientific craze of the period was no less in evidence in Prussia than in this country, and it was due to Frederick William that Kunkel was put in possession of a chemical laboratory at Potsdam for the purpose of furthering his researches.

Science, as a study, had become at that epoch, almost as essential a portion of the man of fashion's daily life, both in England and in Germany, as his toilet.

Charles II was fascinated by the mysteries of chemistry. He called for the exhibition of the substance which was then described as "one of Nature's wonders," and accordingly phosphorus was submitted to the royal gaze by a German

interested in its production and named Krafft. This, it is said, took place at the Royal Laboratory of Whitehall, notwithstanding the fact that, according to Macaulay, " Half the jobbing, and half the flirting, went on under its roof."

Samuel Pepys, in his Diary, records that in 1667 : " Chemistry divided for a time, with wine and love, with the stage and the gaming table, with the intrigues of a courtier and the intrigues of a demagogue, the attention of the fickle Buckingham."

Macaulay writes that : " Charles himself had a laboratory at Whitehall, and was far more active, and attentive, there than at the Council board. It was almost necessary to the character of a fine gentleman to have something to say about air pumps and telescopes."

Pepys states that, " even the ladies of the Court became afflicted with a scientific mania."

The monarch whom Macaulay characterized as " addicted beyond measure to sensual indulgence, fond of sauntering and of frivolous amusements," found time to study the virtues of phosphorus. For he was nothing if not " an observer of men and things " (David Hume).

History records that the period of 1660 onwards was an era of experimental science : " Dreams of perfect forms of Government made way for dreams of wings, *with which men were to fly from the Tower to the Abbey*—and of double-keeled ships which were never to founder.

"Chief Justice Hale, and Lord Keeper Guildford, stole some hours from the business of their courts to write on hydrostatics."

Pepys, however, appears to have been of the opinion that the ladies of the Court congregated, upon the occasions of these scientific gatherings, more for the purpose of criticizing each other's costumes than in the interests of science. He was disappointed at the meagre attention bestowed by the Duchess of Newcastle upon the wonders shown her at the Royal Society's assembly, the probable explanation being that Mrs. Stewart was present.

Phosphorus, which derives its name from the Greek word "phos" (light) and "phoros" (bearing) is a metalloid. It is prepared commercially in two varieties, the one crystalline, the other amorphous. Crystalline phosphorus is usually kept under water in order to prevent its oxidation. It is used in the form of sticks, of a somewhat waxy appearance.

Amorphous, or "red" phosphorus, is made by heating white (or as it is sometimes called, "yellow") phosphorus.

It possesses, however, remarkable allotropic * properties—inasmuch as if heated to about 260°, it is converted to "white" phosphorus. Thus the "red" phosphorus is merely the "white" variety, made to occur under another form.

* Allotropic means the existence in two or more forms of an element, each form having distinct properties.

This other form, however, possesses totally different properties. In order not to weary the reader, I will proceed to summarize briefly the difference between white and red phosphorus.

White or Crystalline Phosphorus :

(1) Is of a soft, waxy nature, possessing a pungent odour not unlike that of garlic.

(2) When warmed it catches fire, burning with a brilliant white flame.

(3) It is so sensitive that mere friction will fire it.

(4) Is highly luminous in the dark, and to this fact it probably owes its designation.

(5) Changes on exposure.

(6) Becomes oxidized and converted into phosphoric acid (highly poisonous).

(7) It is a powerful, irritant poison of a highly deceptive nature (due chiefly to its characteristic slowness of, and uncertain action).

(8) The vapour given off by white phosphorus is also very poisonous.

(9) Burns on the body, produced by white phosphorus, are generally of a most serious nature, on account of their slowness in healing.

" Red " Phosphorus :

(1) Is a reddish-brown substance, of somewhat hard nature, devoid of odour.

(2) When heated to 260° it becomes once more white phosphorus.

(3) Does not give off fumes in the air, as does

the white, and does not possess the luminous power of the white variety.

(4) Does not change on exposure.

(5) Cannot be fired by ordinary friction.

(6) It is non-poisonous when free from particles of the white phosphorus, but whenever it contains the latter it is highly dangerous.

Red phosphorus, it should be added, was the invention of an Austrian chemist, having been discovered by Schrötter in 1848.

The question will probably arise as to why the white phosphorus is mixed with the red variety by the Germans, when used for shells ?

The reply is :

White phosphorus could not be made use of alone for this purpose because :

(*a*) It may be ignited by mere friction.

(*b*) It would burn away too rapidly.

When, however, the mixture contains a large percentage of the red variety, ignition will only be produced by the subjection of the mixture to a great heat, such as that produced by shell fire, for example.

The red, retarding the combustion of the white, causes it to burn in a very slow, serpent-like fashion, and the red will probably become once more white phosphorus of a highly poisonous character.

Thus we arrive at the inevitable conclusion that by the time the shrapnel bullet, or shell fragment, strikes or enters the body, the phos-

phorus will have accomplished its deadly mission, viz.:

(*a*) Of burning slowly.

(*b*) Of having a highly poisonous effect.

The statistics of wounds in warfare show the impossibility, as a rule, of obtaining reliable figures as to the precise number of men killed or wounded by any particular instrument of artillery. It is therefore doubtful if precise data will ever be forthcoming as to the number of men poisoned by phosphorus in this war.

It suffices to add that, although I have taken as an example the German "77" shell, the poison is similarly contained in the greater portion of German shells of larger calibre.

The medicinal dose of white phosphorus is $\frac{1}{20}$ to $\frac{1}{30}$ of a grain.

Uncombined white phosphorus is, however, so dangerous that it is rarely, if ever, prescribed in that form. But in combination with various other articles it enters as an ingredient into a variety of pharmaceutical preparations, its chief use, therapeutically, being as a nerve tonic. As to the minimum lethal dose, opinions differ somewhat, but Sir R. Christison records a case of death at the long delay of twelve days, resulting from a dose of $1\frac{1}{2}$ gr.

Red phosphorus is comparatively inert; there are records of as much as 90 gr. per day having been taken for forty days, with apparently no serious result.

It is to be noted, however, that in this instance the red phosphorus was perfectly free from the white, and that wherever the *white is present in combination with the red*, the combined preparation is highly poisonous.

It is seldom that phosphorus is used in this country in attempts at murder or suicide—probably its odious smell and unpalatable taste render such use unpopular, apart from the reasons given hereafter. It may, therefore, be safely assumed that the number of surgeons of the R.A.M.C. now at the front who have had actual experience of phosphor poisoning prior to the war is remarkably small—and this fact, coupled with the known difficulties in the detection of the poison, and in the recognition of the symptoms produced by it, still further affects the chances of obtaining reliable evidence.

The number of phosphoric fatalities in this country may be said to have risen and fallen with the employment of white phosphorus, in match making.

When matches were first made in England by Walker of Stockton, in 1830, and afterwards when they came generally into use about 1839, records of deaths from phosphor poisoning were conspicuous by their absence.

Since Germany discovered and first produced phosphorus, it is not surprising to find that country is to-day the largest producer of matches. Of these Germany boasts of an annual production

of the value of £4,600,000 as against Great Britain's £800,000.

The Chemische Fabrik Griesheim Elekktron of Frankfort is probably the largest phosphor factory in the world, and its directors should know something about the source of the supplies used in the German projectiles, although I do not suggest that they are responsible for the usage thereof in warfare.

Since 1907 the use of white phosphorus in matches has been forbidden in Germany.

In 1910 an Act of Parliament was passed in England, forbidding the use of white phosphorus in the manufacture of matches, and the importation of foreign matches manufactured from the same.

The "safety matches" of to-day contain no phosphorus—but in lieu thereof a layer of red phosphorus is contained on the sides of the box.

The fact that red phosphorus is non-poisonous (when no white is present) has frequently led people to suppose that the white possessed the same characteristics.

A "rat exterminator" was once largely sold in the United States of America, labelled "Not poisonous, no danger." It contained 2·13 per cent. of white phosphorus: two children were killed by it—in 1894, at Yonkers, N.Y.—and the makers were arrested.

Taylor records the case of a woman who swallowed the scrapings of a number of lucifer

matches. As these were made with red phosphorus the woman was not affected. She thought the red was poisonous, and was disappointed in her efforts to end her existence.

She then, however, proceeded to repeat the dose, but with match heads made from white phosphorus, and from the effects of this latter poisoning she died.

Cases of phosphor poisoning are nearly six times as numerous in France as in England. In Germany and Austria-Hungary the proportion is very large, probably owing to the extensive sale of German-manufactured "rat pills" which contain the white and red in combination. These "rat pills" appear from statistics to be, in Hungary, somewhat popular among wives in dealing with recalcitrant husbands.

In the ancient medical literature of the Ayur Veda, about 900 B.C., the administration of and antidotes for poisons are treated. It is set forth that:

"As the enemies of the Rajas (bad women) sometimes mix poison with the food, on this account the cook should be of good family, virtuous, faithful, and not covetous, neither subject to anger, pride, nor laziness."

During the Balkan War, visiting Budapest on the outward journey, I was pleased to renew the acquaintance of a very intelligent friend whom I had met in Paris. He was a man of letters, albeit a *bon viveur* and a dandy.

Subsequently, when the monotony of the return journey was broken, for a spell, in the Transylvanian Alps, at Sinaia, taking a favourite walk in one of the picturesque paths near the palace of the late King Charles, I was somewhat startled by the greeting of an unkempt, tottery apparition, in whom I scarcely recognized a once leading light of Parisian clubland. The gait of a man of vigour had been displaced for that of one who might have been suffering from a severe form of lumbago, accompanied by melancholia. The face had lost its fullness, and eyes, now of a yellowish hue, glared in vacant fashion. The skin was tinged a lemon-yellow colour, the corners of the mouth turned down, and the forehead wrinkled.

A mild inquiry as to what ailed him produced a maniacal expression of countenance, which suggested that this was a topic best left alone; but I afterwards ascertained that he had suffered from jaundice, and then had serious liver disorder, resulting from a dainty dish prepared for him, by his wife, in the form of a plate of soup, said to contain a portion of a phosphor rat pill.

It may be gathered that the effect of this poison upon the troops will be largely dependent upon the exigencies of the moment. It might be inhaled in some cases, thereby producing disastrous symptoms, for Vauquelin, by exposing himself to the vapour of phosphorus, proved that the poison is absorbed and diffused through the

body, also that the breath of a person so poisoned is luminous in the dark.

Glaister states that "when phosphorus is taken internally the symptoms of poisoning are generally very deceptive, for owing to its slowness of action the patient may so far recover as to give the impression of being almost cured, and it may be that, several days after, a *new set* of symptoms will appear—often accompanied by jaundice, fatty degeneration of the liver and violent epigastric pain."

In a case recorded by Dr. West in 1893, a second period in which health seemed to be restored is noted. It lasted six weeks from the date of poisoning.

Taylor, referring to the "delay in appearance of the symptoms, and their similarity (taken as a whole) to disease," states as follows: "If it were not for the peculiar character of the circumstantial evidence, these cases might easily throw a practitioner off his guard. In general, several days elapse before a fatal result occurs, and during this time the patient undergoes much suffering."

Thus a wounded soldier poisoned by a phosphorized bullet or fragments may depart on leave, light-hearted and contented, only to suffer subsequently the miseries of jaundice, with serious kidney and liver disorders—from which he may never recover—and thus is accounted for the fact that great numbers of phosphor poisoning cases

were not, and have not, been detected or recorded in this war.

Beyond doubt the slow, and very deceptive action of the poison weighed heavily as a factor in the minds of the German chemists conceiving its usage in warfare.

The marked discrepancies in the duration of symptoms, and delay in their appearance, have been accounted for by various authorities. Dr. Smith writes that modern research has explained these symptoms as due chiefly to fatty degeneration of the liver and heart, " due to the power which phosphorus is now well known to possess, of inducing degenerative changes."

The period at which death takes place " varies greatly," and according to toxicologists it may supervene after several weeks.

To illustrate this remarkable variation I may say that Dr. Habershon records a case in which death took place in half an hour. On the other hand, the French *Journal de chimie médicale* reports the case of a woman who swallowed phosphor rat paste—and she did not die until the fifth day following the taking of the poison. In fact, many cases have been recorded by Continental observers, of death after a long delay, with a partial recovery intervening. Glaister says they recover and subsequently relapse in the most despondent fashion. The theory of Continental experts is that phosphorus is a blood poison, and that it passes directly into the blood.

Another dangerous phase which has been engaging the attention of French professors, is that of the burning caused by the German phosphor bullets and shell fragments.

Can the symptoms of burning exhibited by the French wounded have been caused by ordinary bullets ? This is extremely improbable, in fact almost impossible. Most authorities are agreed that a bullet of the nature described does not enter the body at such a temperature as to cause burning at all. Major Girard of the United States army sets forth, as the result of extensive observations, that a bullet never exceeds a temperature of 150° F. MM. Nimier and Laval attach no importance to the heat acquired by bullets discharged in warfare. Similarly, quite a dozen leading authorities might be quoted in demonstration of the fact that a bullet enters the body at a comparatively harmless temperature.

A burn may be produced either by the application of heat or by a chemical.

A burn produced by heat will exhibit, amongst other characteristics : singeing of the hair of the body and singeing of the clothing. That produced by phosphorus will exhibit direct combustion of the tissues and, probably, colour stains on the skin.

The antidote much in vogue is French turpentine ; nevertheless, cases have been reported in the present war, as the result of German shrapnel fire, wherein this remedy proved of no avail.

Seeing that the Allied Forces are waging war against enemies who do not scruple to make usage of the most diabolical methods, opposed to all the traditions of civilized warfare, the important question arises as to what may in future constitute the wounded soldier's right to assistance or pension at the hands of the War Office authorities. The grave physical and other disorders which may become manifest, in spite of the fact that the soldier's wound is healed, in many cases, will prevent him from following any vocation, and these circumstances should be hereafter taken into account.

ARTICLE IV

BARON DE BIEBERSTEIN ON AUTOMATIC CONTACT MINES : GUN-COTTON, ITS HISTORY AND COMPOSITION : T.N.T. : GERMAN "TRIPLASTIK" : CORDITE AND NAVAL DISASTERS : TOLITE : CRESYLITE : MELINITE : LYDDITE : PICRIC ACID : THE TURPIN EXPLOSIVES : MINING EXPLOSIVES IN WARFARE

In conversation concerning the vagaries of The Hague Convention, as applied to the regulations regarding contact mines, an ex-British naval officer once referred to the speeches of his Excellency Baron Marschall de Bieberstein, the German delegate, as being "hypocritical." I give below one of the Kaiser's ambassadorial representative's characteristic orations.

Scene: the eighth plenary meeting at The Hague, October 9, 1907.

An attempt had been made by a sub-committee to codify regulations in the "Interests of humanity," as to the avoidance of danger to neutrals and non-combatants, arising from the usage of contact mines.

The delegates being chiefly engaged in the subtle art of looking after each other's interests and these being of a divergent nature no practical solution was arrived at.

The British delegate, Sir Ernest Satow, had proposed that the use of floating automatic contact mines should be absolutely prohibited. The laying of anchored mines should, he proposed, be subject to their being so constructed that they became harmless if they broke adrift. Sir E. Satow proceeded to demonstrate, as he said, in the interests of humanity, the grave danger that unmoored mines presented to maritime commerce, and the reprisals which would ensue, as a consequence of damage to neutral trade in the event of their usage.

The other delegates appear to have been influenced by Baron de Bieberstein, who accepted the responsibility of reply, of which the following is a translation :

" A belligerent who lays mines on the high seas assumes the entire responsibility towards neutral Powers and peaceful traffic. On that point we are all agreed. No one would have recourse to such an expedient without pressing military necessity. Now military necessity is not the only subject dealt with by international law. There are other factors. Conscience, sound judgment, and the feelings of duty imposed by *principles of humanity will be the primary considerations* of naval officers, and will give *a sure guarantee against abuses. The officers of the German navy, I say it proudly, will always be guided by the unwritten laws of humanity and civilization.* I have no need to say that I

thoroughly realize the importance of codifying the conditions of warfare ; but such code must be studiously kept clear of all laws which it may be impossible to observe through stress of circumstances. It is of the greatest importance that the international maritime law, which we would create, should only contain those clauses which it may be possible to observe even in exceptional cases ; otherwise international law will be brought into disrepute and its authority will vanish. As for *considerations of humanity*, I cannot admit that any Government or country is, *in this respect, superior to that which I have the honour to represent.*"

Although it may have no immediate bearing upon the foregoing speech of Germany's delegate, I cannot refrain from reminding readers of the result of an ex-U.S.A. naval officer's interview recently with German officers in Germany. This appeared in the *Daily Telegraph*, from which the following is an extract.

" Whatever was committed in Belgium cannot be called barbarism on the part of the German army, but once let us get into England and there will be no way of holding back our soldiers, and no doubt the world will learn of atrocities committed unknown of to-day."

At The Hague Conferences China violently protested against the immense amount of damage caused to her goods and subjects by the floating mines dropped by the Russians and Japanese

during their struggle. The Chinese pointed out that though it was three years since the mines were dropped, they were still obliged to provide their coastguards and coasting vessels with means of collecting and destroying the floating mines which threatened not only the high seas but also territorial waters. They further stated that though taking every precaution, a great number of small craft had been destroyed with all their crews, to the horror of the eastern world, and that 500 or 600 Chinese, while carrying out their peaceful occupations, had met a violent death caused by these dangerous machines.

Lord Loreburn, in "Capture at Sea," says, "Our country lives on imports and exports, and if these are interrupted the population will be starved. It is vital to us that our communications be free in time of war, and all our concessions should be made with that object; but can we be sure of always succeeding? Is it to our interest to abolish the right of capture and uphold the freedom of commercial navigation so stubbornly refused by us for many centuries."

Since Britain held the monopoly of maritime trade, and the domination of the seas, she was deemed, rightly or wrongly, by the opposing delegates, to have an axe to grind other than the "interests of humanity." The upshot of these lengthy international conferences was that in principle the main problems remained unsolved. The provisions of the Con-

vention No. 8,* dealing with this subject, do not especially prohibit the laying of contact mines in open waters beyond the territorial, three-mile limit. For such prohibition we are dependent upon the laws of humanity, but prior to the present disastrous conflict, the most eminent German writers on international law deemed it prudent to go so far as to declare that they failed to recognize, under international law, the "territorial limit" as being three miles at all. This zone, they state, is governed by the limit of gun range, and one of the leading German authorities placed this as being ten miles.

The Convention 8 referred to was, however, ratified by Austria-Hungary, but only by Germany with the important reservation of Article II,* which article, in effect, prohibits the placing of such mines along the coast of an enemy, or before its harbours, with the main objective of damaging maritime commerce.

Contact mines are frequently charged with wet gun-cotton. It is compressed until as hard as ordinary wood—and then cut into slabs—shaped not only for contact mines, but for torpedo heads, for which it is also used.

Cotton, in various forms, enters into the composition of numerous other British and German explosives now in use, and also the French, such as the famous Poudre B., which is utilized for

* Appendix IV, p. 134.

filling some classes of the "75" shell, and many other projectiles.

Gun-Cotton. Few explosive discoveries have been of such far-reaching importance, and few have met with such a chequered career, as that of nitro-cotton, generally termed gun-cotton. Unlike many modern explosives it owes, not it is true its actual origin, but its origin in a serviceable form, to the untiring zeal of an English chemist, Sir Frederic Abel, who was materially assisted in his researches by the British War Department.

During the Crimean War (1854) Nobel is stated to have first used submarine mines of gun-cotton in an endeavour to prevent the enemy ships from entering the Neva. The difficulties attending its manufacture, however, probably prevented such mines coming generally into use. In 1844, a professor of chemistry at Basle, C. F. Schönbein by name, discovered ozone, and this is said to have led to the evolution, by the same chemist, of gun-cotton in 1845. The inventor came to England in 1846, in order to demonstrate at Woolwich and Portsmouth the power of gun-cotton, and in the same year he obtained a British patent, under the name of "John Taylor." The Faversham Powder Factory paid him £1000 and entered into an agreement, by which Schönbein was to receive a third of the yearly profits, in consideration of his invention. But in 1847 the powder factory was blown up by gun-cotton,

and twenty-one men engaged in its manufacture lost their lives. Soon after, similar explosions in the manufacture of gun-cotton took place at Vincennes, and at Bouchet, in France. Such a sensation was created by these accidents that both England and France forswore the manufacture of gun-cotton for nearly sixteen years. After a long interval Austria acquired the process of gun-cotton for 30,000 gulden. It was viewed, however, with hesitation by the other Powers, and their surmises became justified when, after the loss of many guns by explosion, Austria's Hirtenberg gun-cotton magazine blew up. In 1865 another terrific gun-cotton explosion took place, near Vienna, causing Austria to prohibit its manufacture. In 1862 Baron von Lenk (Austria), having secured the patronage of Napoleon III of France, and under the name of Révy, took out English patents for an improved gun-cotton process, with the result that its manufacture was once more adopted by an English firm, who met with the doubtful reward of having their factory partially blown up, as a consequence.

Under the direction of Abel, the English War Department then took up the manufacture of gun-cotton, and in 1866, and 1867, Abel confided to the Royal Society some remarkable results of his researches on gun-cotton. These experiments had the effect of revolutionizing the manufacture of such explosives. In fact, by Abel's process, gun-cotton became one of the safest known

explosives, both to manufacture and to use. The improvements effected mainly consisted of the pulping of the gun-cotton, its compression, and purification; subsequently it was found (by an English chemist) that gun-cotton, if dried, could be violently exploded by detonation, and this led to its use becoming general. In 1886 picric acid came into use as an explosive, and thereafter from time to time was employed for contact mines, under various names.

T.N.T. At present, however, the explosive in most general use for automatic contact mines is tri-nitrotoluene, or "T.N.T." as it is popularly called. Gun-cotton had the disadvantage of danger of premature explosion, when employed with a primer. Picric acid has been found inferior to T.N.T. in contact mines, for various chemical reasons, and T.N.T. has the advantage of being much less costly. T.N.T. is prepared by the conversion of toluene and its treatment with nitric acid.

Toluene. Toluene is a colourless liquid obtained from resins such as tolu; the latter being the product of a South American tree. Some of the medicinal preparations of this resin are well known to the public, as "Balsam of Tolu" and "Friars Balsam."

T.N.A. T.N.T. is, however, claimed to be absolutely surpassed both in power and in safety of usage, by a new explosive, discovered by Flürscheim, German Patent No. 242,079. This

is composed of tetranitraniline, and is made by nitrating aniline, of which Germany has a plentiful supply. It is the most powerful solid explosive known to the world to-day.

D.N.T. In 1907 the Germans filled contact mines from Triplastik, which they manufactured from di-nitrotoluene (a deadly poison). This was about the time of Baron de Bieberstein's speech aforementioned, a number of German experts being then engaged upon the especial study of the evolution of automatic contact mines. This poisonous explosive was also tried in torpedoes, and it is possible that the enemy is now employing it for that purpose.

Reverting to the subject of gun-cotton, this explosive is now made by soaking cotton or waste in nitric acid. Cotton is indispensable as it absorbs the oxygen and nitrogen contained in the acid, and is a combustible substance. "Detonation" is the result of heat or shock applied with great explosive energy, whereby the oxygen escapes from the nitrogen and enters into combination with the combustible elements.

"**Cordite.**" The "Cordite" used for naval shells contains 65 per cent. of gun-cotton and 30 per cent. of nitro-glycerine (*see* p. 98).

M.D. This cordite is known as "M.D.," and is largely employed also for German naval projectiles, under a slightly varied form, known as Röhrenpulver (tube powder). The German 10 cm. guns use the article under the military

mark of "R.P. 97." For the 13 cm. Germans guns it is employed as "R.P. 07."

Gun-cotton is used in two forms, viz. the dry and the wet. The dry explodes on detonation, usually with mercury fulminate. The wet gun-cotton contains 30 per cent. of added water, and is thus a much safer explosive, requiring a far greater shock. This is generally produced by employing a primer of dry gun-cotton. From the foregoing, it will be seen that cotton is an indispensable adjunct to the German naval explosive factory.

Naval Disasters. Reverting to cordite, this and most of the smokeless powders are subject to deterioration, and thereby to spontaneous ignition. Naval catastrophes, due primarily to this cause, have been so numerous in the past that it may be safely assumed at least one of those, in the present war, owes its origin to the same action. On the morning of November 26, 1914, England awoke to be shocked with the intelligence that our noble battleship the *Bulwark* had blown up with the terrible loss of between 700 and 800 lives, at Sheerness. All sorts of rumours were afloat, as to enemy submarines, but these may be scouted. The *Bulwark* was loading ammunition, at the time, from barges (which also disappeared).

France lost the *Jéna* in 1907, and the *Liberté* in 1911, both in Toulon harbour, as the result of spontaneous explosion. In the latter 204 men

were killed and 136 severely injured. Similarly Brazil mourned the loss of the *Aquidaba* and 213 men, in 1906. In 1905, the Japanese battleship *Mikasa* went down, with 599 men, blown up, from this cause.

Tolite. Touching the nature of some other explosives to which I have made reference, as used in the present war, tolite is similar in composition to tri-nitrotoluene or T.N.T. By Haussermann's (German) process it is composed of: nitric acid—1 part—and sulphuric acid—2 parts. This acid mixture is then allowed to run slowly into 1 part of heated paranitrotoluene.

The German shells are filled with tolite in the same fashion as with picric acid.

Tolite is in needle crystals of light to dark buff colour, without odour. When burnt, it does not explode, but exhibits a smoky flame. During a fire at a German explosive factory, nearly a ton of tolite burnt quickly away without explosion. A rifle bullet fired through a mass of tolite also caused no explosion. In fact, it can only be exploded by very powerful percussion or by detonation.

The vapour of tolite differs from that of picric acid in the fact that the former is non-injurious.

The explosive powers of tolite are not so great as those of picric acid, or wet gun-cotton. Nevertheless, its destructive effect is said to be greater, particularly so at a distance. This is probably due to the fact that (being of slightly less power)

upon the bursting of a shell, *the fragments would necessarily be larger.*

Cresylite. Cresylite is a solid substance of yellow colour in crystal needles. It burns as does picric acid, and is prepared in similar fashion to that acid, by nitrification of phenol (carbolic).

Melinite. Melinite is fused picric acid. In 1871, Sprengel, a famous German chemist, demonstrated the power of picric acid—but it was not until Turpin took out his patents, in 1885, that melinite appeared. The process consists mainly in the compression of the picric acid.

The same article, with various minor modifications, has since been adopted by all the Powers.

Lyddite. England named the picric composition "lyddite." Germany manufactured it under the designation "Granatfüllung," and Austria styles a somewhat similar preparation "Ecrasite."

Picric Acid. Picric acid, discovered by Woulfe in 1771 and reproduced by Haussermann in 1788, was long used as a natural digestive, before its explosive properties were fully estimated. It is usually manufactured by treating crystallized carbolic acid with acid sulphuric, and running the mixture gradually into nitric acid.

Picric acid is in pale yellow crystalline needles, sometimes of a scaly nature. It has an intensely bitter taste. When strongly heated it burns rapidly away with a dense black smoke. It does not, however, explode when heated under

ordinary conditions. Explosion of the acid is generally effected by detonation with mercury fulminate. It is fairly soluble in water, its solution being intensely bitter, and of a bright yellow colour. Hence its use for dyeing purposes.

In spite of the comparative safety in handling pure picric acid, there have been many accidents in its manufacture, notably, 24 killed and 178 injured at the Griesheim Elektron Company's Works, at Frankfurt in 1901. On June 18, 1903, 16 operators were killed and 14 injured, by a picric-acid explosion, at Woolwich Arsenal.

This acid is known, in the French Pharmacopœia, under the name of carbazotic acid. In the Japanese Pharmacopœia, it is called by chemical description, trinitrophenic acid; the dose taken is from $\frac{1}{4}$ to 2 gr.

Its therapeutic usage is chiefly in the treatment of ague and malaria. A pigment made from picric acid has been very successfully applied, in the treatment of ringworm and other skin diseases.

The vapours given off by picric acid upon explosion, are asphyxiating and highly dangerous to those in the vicinity.

I noticed recently, in the communication of a correspondent, that he confounded picrotoxin with a preparation of picric acid. This is quite an erroneous idea, for picrotoxin is a highly poisonous, bitter principle, extracted from a fruit known as Cocculus Indicus, or "fish berry" on

account of its peculiar effect upon live fish. When picrotoxin is made into balls with dough, and thrown into a river, the fish become, in a very short space of time, intoxicated. Pike and carp will come to the surface, indulging in the gyrations to which salmon are usually addicted. After a time, a second stage develops, and the fish lie flat on, or near, the surface, and may thus be readily caught with the hand. The experiment, however, is a highly dangerous one, and poisoning has resulted from its employment.

The Turpin Explosives. Eugéne Turpin, a Parisian, born in 1848 of humble parents, in that capital, studied dentistry in his early days. This occupation, however, he soon abandoned in favour of the mysteries of science. In 1877 he surprised the world with his " non-poisonous colour " inventions.

At the age of 33, in the year 1881, he carried out sensational discoveries touching explosives. From his famous laboratory, at Charonne, he subsequently evolved " panclastite " (a very dangerous explosive made from nitiric peroxide), also " melinite " from picric acid. Having parted with the result of his arduous labour to the French Ministry of War, he found himself accused of complicity in the subsequent sale of one of his secrets to an English company. Stoically he bore the accusation, and eventually his innocence was established. The great inventor, a victim of political intrigue, had no sooner

emerged from this trying ordeal, than he was sentenced to five years' imprisonment for having, it was alleged, divulged State secrets in his historic announcement, "Comment on a vendu la mélinite." It was characteristic of Turpin that his heroic fortitude never forsook him, and without cessation, he proceeded to subject the French Ministry to a bombardment of accusations, resulting in his final pardon in 1893. The inventor's indomitable spirit, however, was roused, and he unceasingly demanded the complete annulation of his unjust sentence. M. Waldeck-Rousseau, General André, and many French notables championed the cause of this suffering martyr, whose wounds they attempted to heal, with the result that his services were taken over by the French Ministry of War and in part consideration therefor he was paid the sum down, of 50,000 francs.

With reference to the recent inventions of M. Turpin—without divulging secrets—I may say that I believe this chemist to be responsible for certain inventions now in use in the French trenches. As to the existence of a novel explosive, emanating from the same laboratory, the discovery of which was reported some time since, Monsieur d'Arman, in his recently published work, states (with the authority of M. Turpin), as follows: "ce que je puis garantir, c'est que ces inventions existent, qu'elles vivent, et sont capables de jeter dans la guerre de taupes et de

termites que nous voyons se poursuivre, des éléments décisifs de victoire."

Mining Explosives in Warfare. An explosive is generally termed "high" when it is capable of being fired by detonation, or instantaneous explosion, and "low" when the explosion is comparatively of a slow nature.

Thus, for comparison, the distinction between "lyddite" and gunpowder.

The most powerful detonator is mercury fulminate. Nitro-glycerine, or even gun-cotton, if burnt in an open vessel, will not explode, but the moment they are fired by detonation, explosion follows, the explosion being due to decomposition.

In 1846 Sobrero discovered nitro-glycerine. He was a clever professor of chemistry at Turin.

The subject of his discovery was put to the test, in the laboratories of European War Departments, and found wanting—being considered far too dangerous for handling in warfare. Nitro-glycerine was therefore, for the time being, relegated to medicinal usage. At the present time it is much prescribed for angina pectoris, dyspepsia, and other complaints. A weak solution is used for hypodermic injection, in cases of collapse, where there is difficulty in swallowing. It is also made in the form of tablets, each containing $\frac{1}{100}$th of a grain.

To relieve angina pectoris, asthma, sea-sickness, etc., these tablets are reported, in medicinal

literature, as of considerable value. They are stated to be non-poisonous; in fact, a case is recorded of two children having made a meal, between them, consisting of two dozen tablets of nitro-glycerine, without the production of serious consequences.

A laboratory employé, in another instance, partook of two ounces of nitro-glycerine, mistaking it for chocolate, and on the morrow was none the worse for his stupidity.

Hungry soldiers have been known to suck cordite, containing a large percentage of nitroglycerine, with no more inconvenience, as a consequence of their rashness, than a supervening headache.

Nitro-glycerine is made by the addition of glycerine to a mixture of nitric and sulphuric acids.

In 1862, and thereafter, Alfred Nobel commenced to manufacture nitro-glycerine, he having discovered the power of this explosive, under detonation. In 1864, the Heleneborg Works, near Stockholm, where the manufacture took place, were blown up by nitro-glycerine. In this disastrous explosion perished the brother of Nobel, and his father was the recipient of injuries from which he failed to recover. Alfred Nobel undeterred, erected a new factory at Krümmel, under German auspices.

In 1867, after suffering many more accidents, Nobel took out patents for a mixture of nitro-

glycerine with a fossil absorbent earth termed Kieselguhr, thereby providing the missing link in the production of a comparatively safe explosive for blasting purposes, now known as "dynamite," or "Guhr-dynamite." By 1873 fifteen factories had been equipped for manufacture of these explosives. In 1875 the same genius followed with the invention of blasting gelatine, or gelatine-dynamite, much in use for mining to-day, and made from nitro-glycerine and collodion cotton.

Other explosives sometimes employed, in blowing up enemy positions, bear the fancy names of donarite, and cheddite, the former being made from nitrate of ammonia, and the latter from chlorates.

Ammonal. Another explosive used in warfare mining is known as ammonal, and is prepared from ammonium nitrate. It was invented by Von Dalmen, and is largely used by the Austrian army for mining, also for filling high-explosive shells.

It possesses a remarkable characteristic, viz. extraordinary stability, so that shells filled with ammonal will keep in any climate for years.

It only takes fire with difficulty, and is considered one of the safest explosives known.

The dynamite and ammonite class comprise, in fact, a number of mining explosives in use under various designations.

There is little doubt that the want of a non-

asphyxiating explosive, for mining in warfare is keenly felt to-day. "High" explosives have a considerably greater percentage of oxygen than those of the "low" variety. In the "high," the chemical changes take place much more rapidly. All explosives, however, the so-called "safe" included, give off asphyxiating or noxious fumes, which are particularly dangerous in enclosed spaces, such as underground tunnels.

In Article I, under the heading of "Blowing up the Enemy," I refer to some of the poisonous effects of these explosions, and to the heroic nature of the sapper's silent task.

Berthelot lays it down that, the "formation of a large volume of gas" is a necessary quality of an explosive. Even gunpowder, when used for blasting purposes, has its dangers, for upon explosion large volumes of gas, at a very high temperature, are produced.

Dr. Haldane, the scientist who is now engaged at the front in investigating, for the British War Department, the poison gas used by the Germans, has made exhaustive experiments concerning the effects of mining explosives. These are chiefly contained in his "Reports to the Home Department."

In 1878 Professor Berthelot was appointed by the French Government, president of a commission formed for the purpose of studying these questions. As a matter of fact, during the siege of Paris, in 1870, the French War Department

called upon Berthelot to renounce his scientific engagements in order that he might give his country the benefit of his especial knowledge in this direction. In 1887 another French commission was appointed to inquire into these matters. This Commission appears to have arrived at the conclusion that explosives employed for mining purposes, which upon explosion would have a high temperature, for example, nitro-glycerine and gun-cotton, would be safer if mixed with any substitutes having a low temperature, and these researches led to the introduction of explosives of the so-called "safety" variety in France. By the admixture of ammonium nitrate (having a lower temperature) it has been found, however, that there are various disadvantages in the employment of this compound.

Roburite. Roburite, a similar composition to which was, at one time, largely in use by the Germans, caused a great number of cases of asphyxiation, these being chiefly due to the carbon-monoxide given off. A committee was constituted to investigate the subject, and arrived at the conclusion that a longer time ought to be allowed to elapse, before approaching the point of explosion.

ARTICLE V

LIQUID-FIRE SPRAYS : INCENDIARY BOMBS : SHELLS AND PASTILLES : THEIR HISTORY AND COMPOSITION : ZEPPELIN BOMBS : THERMIT

A TREMENDOUS sensation was caused when a French official communiqué gave first intelligence to the effect that the Germans were spraying the French troops with "liquid fire," also that they were utilizing pitch and sulphur.

In some quarters our adversary was credited, on this account, with remarkable ingenuity, but as a matter of fact the talent displayed has mainly consisted in the revival of ancient methods of warfare.

The English used, in the earliest days of wooden ships, balls of pitch mixed with sulphur and naphtha, the missiles being termed "wildfire."

Marshall gives an interesting account relating to the "sea-fire" of A.D. 668, as follows : "Some forty-six years after the flight of Mohammed from Mecca to Medina, the Arabs, still at the height of their conquering enthusiasm, commenced to beleaguer Constantinople by land and sea, when an architect named Kallinikos fled from Heliopolis in Syria, to the Imperial City, and imparted the secret of the sea-fire. This repeatedly spread such terror and destruction among the

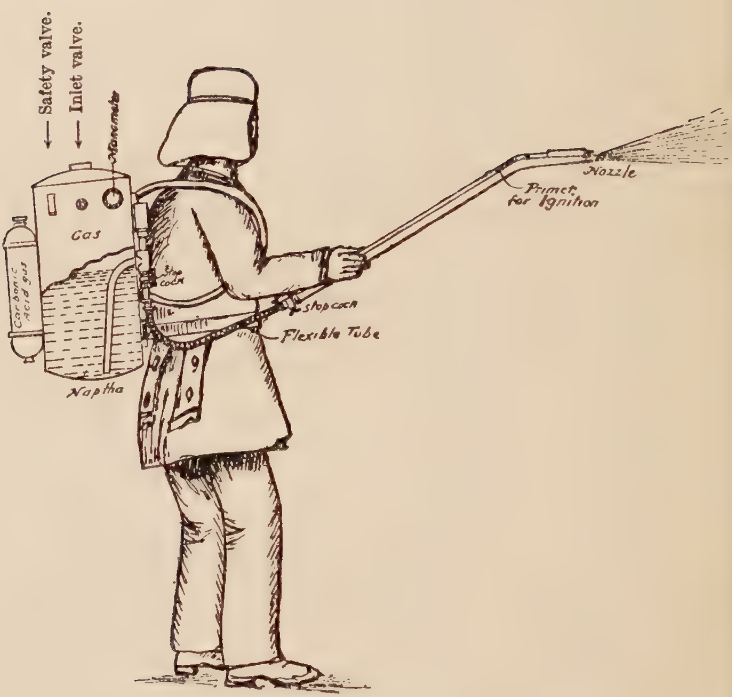

FIG. 9. The "liquid-fire" spray.

Moslem fleet, that it was the principal cause of the siege being eventually raised after seven years. In A.D. 716 to 718, the Arabs again appeared before Constantinople with eighteen hundred ships, but again were defeated by the fire; so effectually, that after a stormy passage only five galleys re-entered the port of Alexandria, to relate the tale of their various, and almost incredible disasters."

Russian Naval forces were similarly defeated in 941 and 1043, and the Pisans at the end of the eleventh century.

What then was the nature of this " sea-fire " ? It was discharged from tubes or siphons in the bows of the ships, but its mode of preparation was kept a close secret, and it was never used successfully by anyone but the rulers of the Eastern Roman Empire.

Colonel Hime concludes that it was composed of naphtha, quick-lime, and sulphur.

The Moors made continual usage of incendiary missiles about the years 1240 to 1260. At the siege of Weissenburg, in the year 1469, stone balls were in vogue, covered with an incendiary composition.

Our " State Papers " show that incendiary devices were favoured about 1588.

In 1599 the Government ordered " 184 Slurbowe arrowes with firewoorkes."

Fire-lances or pikes were long employed until about 1660. According to Hime, they were

last in use at the first siege of the city of Bristol in 1643. He refers to Prince Rupert's Diary wherein occurs the following passage: "Running in upon the Royalists with *fire-pikes*, neither men or horses were able to endure it. The fire-pikes did the feat."

Berthelot refers to an experiment made at Havre in 1758 with a *naphtha pump*, the jet of which was inflamed,—"*par une mèche allumee on brula même une chaloupe.*"

In 1860 the Chinese employed "fire arrows" against the French. In 1863 the enemy was sprayed with fire, by means of naphtha pumps, at the battle of Charleston.

In 1870, during the siege of Paris, it was proposed to utilize "petrole fire-pumps" against the enemy, but records seem to show that such means of incendiarism was not eventually resorted to.

A member of the French Army Medical Corps gave the following account recently to Reuter's correspondent of the employment by the Germans, in the present conflict, of fire-sprays and torches: "After a relatively calm day they were startled by finding jets of petrol being directed against their trenches.

"The officer immediately ordered his men to put out their pipes, but this was no use, for a few seconds later fire-grenades rained on them, and in a few moments the trench took fire. The Germans, profiting by the confusion, approached

and threw lighted torches, which increased the blaze.

" No one could escape from the torrent of fire, and the position became untenable. With their clothes streaming with petrol, the French were forced to abandon the trench. The second line, which had entrenched a few yards behind, had succeeded in checking an attack, which the Germans delivered ten minutes later.

" A vigorous counter-attack by the French, eager to avenge their comrades, wrought terrible havoc in the enemy's ranks, and the Germans were forced back to their original position, leaving 150 dead and as many wounded on the field, while sixty prisoners were taken."

Mr. Philip Gibbs, the Special Correspondent of the *Daily Chronicle*, forwarded the following communication from France upon the subject:

" A stretcher-bearer, working with a French ambulance unit at the front in the Argonne, confirms the fact that the enemy has adopted the new and horrible method of attacking trenches by drenching them with an inflammatory liquid.

" The first news of this new departure on the part of the enemy was given in the French official report last Saturday, wherein was stated: ' In Malancourt Wood, between the Argonne and the Meuse, the enemy sprayed one of our trenches with burning liquid, so that it had to be abandoned. The occupants were badly burnt.'

" This official account does not convey in any little way the horror which overwhelmed eye-witnesses of the sufferings of those brave French soldiers, who were severely burnt by this new invention of war.

" A detailed narrative of the first attack by liquid fire was given by one of the less seriously burnt soldiers. ' It was yesterday evening,' he said, ' just as night fell that it happened. The day had been fairly calm, and nothing fore-warned us, as is usual, of a German attack.

" ' Suddenly one of our comrades shouted, " Hullo, what is this coming down on us ? Any-one would think it was petroleum ! "

" ' At that time we were incredulous of the truth, but the liquid which reached in two jets, cleverly directed, was undoubtedly some kind of petroleum. The Germans pumped it on us by means of a hose, perhaps specially made for the purpose.

" Put Out Their Pipes

" ' The sub-lieutenant who commanded us made us put out our pipes. But it was a useless precaution, for a few seconds later incendiary bombs began to rain down upon us. The whole trench immediately burst into flame, and in order to complete their barbarous work those bandits took advantage of our disturbance by advancing on the trench and throwing burning torches into it.

"'None of us escaped this torrent of fire. Our clothes were soaked with petroleum, and we were soon enveloped in flames and forced to abandon our position. But we waited nevertheless until our comrades in the second line of trenches were ready to defend themselves from the German attack which developed a few minutes later.'"

It will be observed, from the historical data, that far from the evolution of any "new and horrible method," the Germans were merely adapting those to which recourse was had very many years since.

The German Liquid Fire-Spraying Machine. These machines are of two varieties, the one portable and the other fixed.

The portable machine is a drum, or reservoir, of oval or cylindrical shape, carried on a soldier's back by means of straps. There is a belt connecting, which passes round the waist of the carrier and keeps the machine in position.

Near the centre of the drum is fitted a tube, which, being bent, reaches nearly to the bottom of the reservoir. The outer end of the tube has affixed a socket to which is attached another tube of a flexible nature, so that it may be turned in the requisite direction by the operator. This flexible tube directly connects with a stop-cock, and the latter with an emission tube.

Towards the end of the emission tube is a striking pin, connected with the stop-cock by

another tube which is bound to the main tube. When the stop-cock is in the course of closing the striking pin is pulled back. When the stop-cock is open it detonates a primer, which automatically sets on fire the liquid utilized.

The emission tubes employed are straight when intended for use in the open, and bent when required for use under cover. The reservoir is divided into two chambers, the upper containing carbonic acid gas for creation of pressure, the lower holding a combustible liquid, such as naphtha.

The lower chamber is first filled, and the orifice closed. Gas is then admitted to the upper chamber until the pressure required is indicated by means of a manometer affixed to the side of the reservoir. The floor of this upper chamber contains holes, allowing communication with the lower one. The gas is contained in a small steel bottle attached by a strap to the reservoir, and communicating with it by a tube, having a stop-cock. Thus, when the requisite pressure is obtained, the gas receptacle may be detached.

The soldier points the spray, or emission tube, in the requisite direction, and opens the stop-cock on the jet tube, whereupon the inflammable liquid is forced out at great gas pressure, and carried in the form of a spray of fire, for a considerable distance.

The liquid having previously been ignited by detonation of the primer, the length of the flames

is regulated by means of the stop-cock aforementioned.

The non-portable machine simply consists of the instrument described above, enlarged, and sometimes of a battery of reservoirs. German soldiers handling these weapons are frequently protected with colliery helmets.

The pitch used by the enemy against the French in the Argonne, and other fields of battle, caused serious injury to the eyes of the French soldiers.

Pitch acts upon the conjunctiva* of the eyes, in an irritant, and dangerous fashion. Burns derived from this source have also been known to result in cancer.

Incendiary Bombs. In A.D. 1250, at the period of the sixth Crusade, Joinville thus described an incendiary missile: "It came flying through the air like a winged, long-tailed dragon, about the thickness of a hogshead, with the report of thunder and the velocity of lightning; and the darkness of the night was dispelled by this deadly illumination."

Marshall surmises that the reason why men of the stamp of St. Louis and Joinville, usually absolutely fearless, should have been terrified by such a cause, and should have described it in such exaggerated language, seems to have been due to the fact that they looked upon it as a product of the devil. By 1250 the Arabs were

* The membrane covering the eyeball.

acquainted with saltpetre, and it is quite likely that they mixed some with the incendiary, causing it to burn far more fiercely.

Incendiary compositions, thrown by hand, and from machines, appear to have been recognized weapons of warfare prior to the introduction of shells, the casting of the latter in metal being then an art unknown.

One of the varieties of the French "75" shell, which I have enumerated, possesses incendiary properties. Shells partaking of these characteristics have, in recent years, undergone many changes, and the evolution of a satisfactory incendiary shell was still an object of study by the German and other ordnance departments at the outbreak of hostilities.

Incendiary "pastilles" have been extensively used by the Germans in the present conflict. They are about the size of an ordinary large lozenge, and of various colours. These pastilles are carried in small canvas bags, by the soldiers, each bag containing several hundreds. The features reported concerning these agents of incendiarism are that they burn away without smoke, leaving no trace whatsoever. A French chemist informs me that when burnt they do not even discolour white paint. Having obtained a bag of such pastilles, I was not allowed to carry it away, and therefore have been unable to examine the contents; but the base is probably aluminium.

Zeppelin Bombs. With regard to Zeppelin and flying-machine bombs, much remains to be accomplished in the way of research and invention. One of the chief problems is the accurate dropping of bombs with the minimum of danger to the machine's crew. Many devices have been evolved, with a view of dropping bombs from a great height with precision—but even the best of these is open to improvement. Another issue is the weight of the missiles, lightness being a necessity. It is stated that, in lieu of filling Zeppelin bombs with ordinary explosive and incendiary compositions only, the Germans propose to employ, in their meditated attack on London, poisons or poison-gas bombs. The poison-gas machine (Fig. 2, p. 25) has a device which can be screwed on or off, and may serve the purpose of filling Zeppelin bombs with such gas (*see* p. 48).

The charge of poison may form the only contents of the bomb or may be inserted therein together with an incendiary agent, such as that described below. The field open to our adversary in the choice of the poisons to be employed is so wide and comprehensive that a book might be written about these and their antidotes alone. Before discussing the best means of prevention one must be quite certain as to the nature of the poison gas used or to be used. Moreover, gases are of different densities, and whereas some might flow

downward, filling the areas and basements of houses, others would be capable of ascending.

I can mention one of the probable lethal weapons with confidence, as I have seen, on the Continent, a Zeppelin bomb undischarged, which was found to contain thermit, but in addition there was a strong charge of a powder, composed of red and white phosphorus (*see* p. 72). The vapour given off by the burning of this composition would be very dangerous, producing amongst other symptoms, necrosis * and luminous breath.

French oil of turpentine is considered the best antidote for such cases, and might be used with respirators. In the event of prussic acid being the base of the poison, respirators soaked with sal volatile would be useful, although the ammonia in the sal volatile might cause some little inconvenience.

For the other gases which the Germans have already adopted, a solution of common hypo or bicarbonate of soda appears to be the most convenient remedy.

Hypo and the carbonate or bi-carbonate of soda, being alkaline, neutralise the effect of the poison. The best result would be produced by a mixture of the two sodas, say :

5 ounces of sodium hyposulphite,
1 ounce of carbonate or bicarbonate of soda
dissolved in enough water to effect a solution, to which may be afterwards added
1 ounce of glycerine.

* For further reference *see* p. 79.

The respirators are soaked in this solution.

The most efficacious protection of all is the oxygen helmet.

Thermit. Besides the incendiary compositions, to which I have already made reference, the German bombs thrown from airships are frequently filled with thermit.

In 1824 Carnot, a French expert, wrote his "Réflections sur la puissance Motrice du Feu," a demonstration of the *pro rata* amount of heat which could be made use of, for the production of mechanical energy or work. In 1843 Joule published his experimental calculations as to the amount of mechanical energy, or work, which corresponds to a specific amount of heat.

In 1848 the late Lord Kelvin, then Sir W. Thomson, proved the value of Carnot's experiments; and from Lord Kelvin's, and other researches, resulted the science "thermo-dynamics" (that appertaining to heat and energy). Thus "thermal heat" has become a term indicating a measured or specific heat, "thermo-chemistry" the science treating of heat evolved in chemical reaction—such as burning or combustion, for example.

In 1898 a German scientist named Goldschmidt reduced the oxides of metals by a process which was not only more practical from a commercial point of view, but safer than that hitherto employed. For this purpose aluminium was selected, on account of the fact that it develops a greater heat (oxidation heat), under certain

conditions, than any other metal. Goldschmidt's process consists of mixing the powdered oxide of any convenient metal with an equally fine powder of aluminium. The product was named "thermit," deriving its title from a Greek word meaning "to warm." In ancient times the Roman public baths were called "THERMAE," and we know certain warm springs as "thermal waters."

Firing. Although such incendiary bombs usually contain no actual explosive, in the general sense to which this term applies, they are, when containing some mixtures, liable to react with explosive violence, and many minor accidents occurred in the earlier stages of thermit manufacture. Upon firing taking place, reaction develops throughout the entire mass of thermit in the bomb, and a heat of 3000° F. is evolved, capable of setting fire to or melting almost anything. The time taken to effect this reaction and to create the fire is the all-important factor, from the public point of view, and this would necessarily be governed by the nature of the metallic compound employed in making the thermit. When an iron compound is used, the average time required to produce such development would be about thirty seconds (it would vary with the nature of the fuse), and this might enable people to evade the effects of the bomb.

I examined several of the thermit incendiary bombs made in Germany only a short time prior

to the war, and these contained a piece of magnesium ribbon, inserted in the top of the receptacle or bomb-case. On the thermit charge, a small quantity of mixture of magnesium, and strontium or barium peroxide in powder, was placed. This was intended to act, in combination with the magnesium ribbon, as a *fuse.* By the time the ribbon had burned, the bomb would possibly have attained its objective, the layer of powder mixture on the thermit would have been ignited, and a reaction would follow, developing an enormous heat and causing fire.

I am informed, however, that in some of the bombs the magnesium fuse is dispensed with; this, however, has not proved an advantage, for the missiles so constructed have been found in many cases unreliable.

Little comfort is to be found in the idea that Germany may run short of aluminium. Even granting such a possibility, a substitute could immediately be found in magnesium mixture with silicon, or even in a calcium and silicon mixture. In fact, many substitutes can be, and probably have been, found.

The bombs weigh from 18 to 28 lb. If they only contain one of the mixtures aforementioned, we have but to look for fire, but I am inclined to the belief that a charge of poison, either of the kind I have indicated or of some other, will be inserted.

ARTICLE VI

THE GERMAN HIGH-EXPLOSIVE AND SHRAPNEL SHELL COMBINED : THE CASUALTIES OF WAR : PERCENTAGE OF MORTALITY AMONGST OFFICERS : HISTORICAL TABLES : PERCENTAGE OF LOSSES IN BATTLE FROM 1704 TO 1870 : RATIO OF KILLED TO WOUNDED IN WARS 1864 TO 1904 : THE BALKAN WAR : INCREASE OF BAYONET WOUNDS

FIG. 10 shows a German howitzer shell combining the characteristics of a shrapnel missile and that of a high-explosive projectile. These artillery weapons are also used in the Austro-Germanic " 98 " field-guns.

During the Balkan War many such shells were fired, and the surgeons present did not fail to emphasize the serious nature of wounds resulting therefrom. It follows that a projectile which emits steel fragments in addition to shrapnel bullets, to say nothing of poison, is liable to cause much trouble to the R.A.M.C.

In the Balkanic trials the shells were found defective in several respects, notably in that the heads were apt to burst prematurely in the air. This has now been remedied by the addition of another " burster " between the shrapnel, and the shell-head, in order that the latter may burst off prior to the discharge of the principal

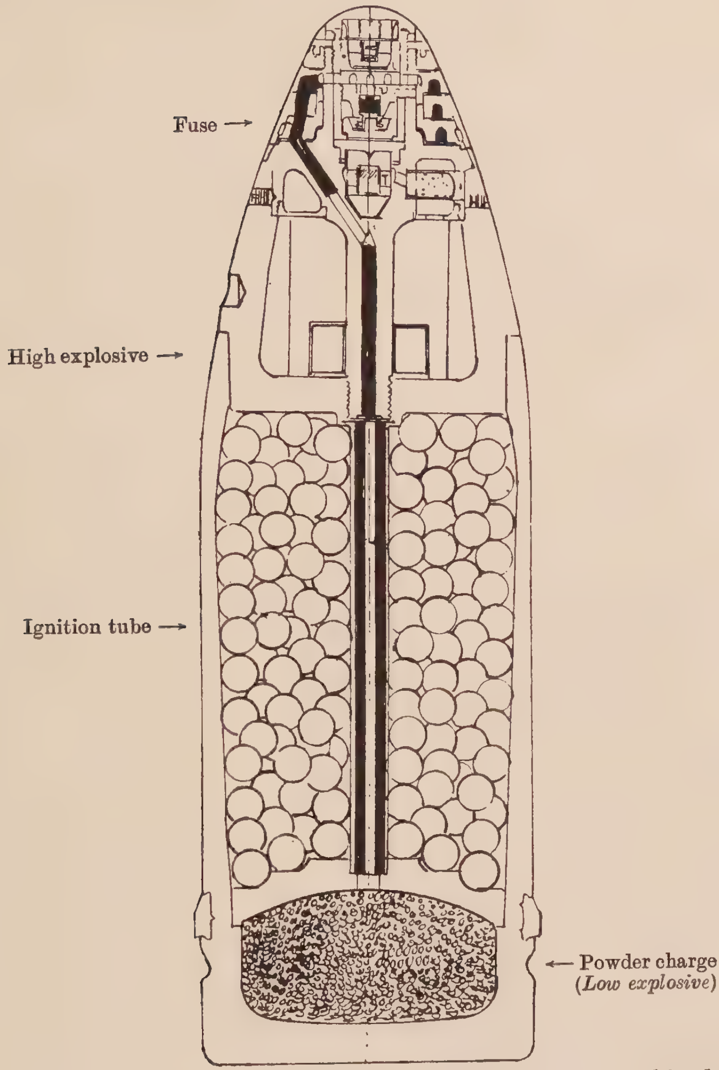

FIG. 10. The German high explosive and shrapnel shell combined.

burster. The chief reason advanced for the use of these deadly weapons in warfare, is that by the provision of modern field artillery with shields, and the erection of barbed wire entanglements and other obstacles, shrapnel alone is rendered ineffective in this direction. The method of filling these shells, and the arrangement of the fuses, is the subject of much variety. In many the base is charged with gunpowder, which, upon explosion by a time fuse, scatters the shrapnel bullets. The high explosive, T.N.T., tolite, or other employed is, in these cases, contained in the head of the shell. The explosion of the powder charge causes the T.N.T. to partially burn, the head of the shell thus travels along alone, and bursts either upon impact or upon action of the special impact time fuse it contains. The shrapnel of these German missiles is largely mixed also with sulphur, or phosphorus poison.

Casualties of War. If it were possible to obtain adequate information, interesting data might be afforded by a comparison between the number of killed in the past as a result of the use of the ancient and muzzle-loading weapons, and those disposed of by means of the various guns, explosives, and poisons now employed, following respectively the march of science and barbarism; but this information is unobtainable, and probably will so remain.

Concerning the high rate of mortality amongst officers, it should be borne in mind that the same

is a noticeable feature if one examines the statistics of other wars. The opinions of leading authorities appear to differ as to whether this may be due to the wearing of distinctive badges, or rather to the fact that an officer is usually in front, and therefore more exposed to fire. The concensus of opinion seems to be to the effect that, at ranges of 1000 yards and more, the enemy's fire is not merely directed to the picking out of individuals, but that at close quarters the distinctive uniform is a source of danger.

Upon this topic Sir W. G. Makins, F.R.C.S., one of the Consulting Surgeons to the South African Field Force, stated as follows in "Surgical Experiences in South Africa": "I much doubt whether, at the end of the campaign, the entire abandonment of distinctive badges will be found to have had any very important result in decreasing the relative number of casualties as between officers and men."

The same authority continues to show that the percentage of men killed in the Boer War up to September 15, 1900, was "slightly lower than in the Crimean War, and nearly corresponded with that observed in the Franco-German campaign."

A perusal of the following Tables may be of interest. The Tables given are compiled from those of Colonel Stevenson, Sir T. Longmore, the Russian Tables published in 1906—those

issued by the German General Staff—the U.S.A. Surgeon-General's Report, and the returns of the British War Office.

CASUALTY TOTALS

The total casualties of :	Of the strength present.	
The British Army in the Crimea was . .	15·1	per cent.
The German Army in the war of 1870–1871 .	13·2	,,
The English Army in the Boer War . . .	7·1	,,
In the Russo-Japanese War the Russian casualties were	12·4	,,
The Japanese losses in killed and wounded were	14·5	,,

CASUALTIES AMONGST OFFICERS AS COMPARED WITH THOSE OF NON-COMMISSIONED OFFICERS AND MEN

(From the Tables compiled by Major Burtchaell, R.A.M.C.)

	Percentage of killed and wounded in proportion to the number of men engaged.	
Battle.	Officers.	N.C.O.'s and Men.
Belmont	8·75	3·15
Graspan	3·06	2·29
Modder River	6·56	4·68
Magersfontein	17·94	8·29

TABLES SHOWING THE LOSSES PER CENT. OF STRENGTH IN VARIOUS BATTLES

Battles and Dates	Strength	Total Losses per cent.
Blenheim, 1704 — British and Allies	56,000	23·0
Blenheim, 1704 — Gallo-Bavarians	60,000	66·0
Kunnersdorf, 1759, Prussians	40,000	65·0
Talavera, 1809, British	22,000	24·6
Vittoria, 1813 — British and Portuguese	60,486	7·6
Vittoria, 1813 — British alone	35,129	9·4
Leipsic, 1813 — Allies	300,000	16·0
Leipsic, 1813 — French	171,000	36·0
Waterloo, 1815, British	36,240	23·3
Alma, 1854 — English	21,481	9·3
Alma, 1854 — Russians	60,000	9·3
Inkermann, 1854 — English	14,000	20·1
Inkermann, 1854 — French	41,800	4·5
Inkermann, 1854 — Russians	55,000	28·6
Crimean War, English	97,864	15·1
Solferino, 1859 — French	135,234	12·7
Solferino, 1859 — Austrians	163,124	13·6
Gettysberg, 1863 — Unionists	117,350	19·7
Gettysberg, 1863 — Confederates	68,352	46·2
New Zealand War, 1863–66, British	7,930	8·6
Prusso-Danish War, 1864, Prussians	46,000	5·3
Weissenberg, 1870, Germans	106,928	1·4
Woerth, 1870 — Germans	167,119	6·3
Woerth, 1870 — French	46,000	36·9
Gravelotte, 1870 — Germans	278,131	7·3
Gravelotte, 1870 — French	125,000	8·0
Franco-German War, whole German Army	887,876	13·2
Beaune-la-Rolande, 1870, Germans	91,405	0·95

CASUALTIES IN CAMPAIGNS SINCE 1864

Campaigns	Killed	Wounded	Total Casualties	Per cent. of Strength			Died of wounds per cent.	Ratio of killed to wounded
				Killed	Wounded	Total Casualties		
Germans in war with Denmark, 1864 .	738	2,136	2,874	1·2	3·4	4·6	(?)	1 to 2·9
Germans in war with Austria, 1866 .	4,634	12,149	16,783	1·4	3·7	5·1	(?)	1 to 2·6
Germans in war with France, 1870 .	28,278	88,543	106,821	3·0	9·4	12·4	(?)	1 to 3·1
U.S.A. in war with Spain, 1898 . .	1,067	5,981	7,048	Strength of army not given.			6·8	1 to 5·6
English in Boer War, 1899 . . .	5,774	22,829	28,603	1·2	5·1	6·3	8·8	1 to 3·9
Japanese, 1904 .	47,387	173,425	220,812	3·1	11·4	14·5	6·5	1 to 3·6
Russian, 1904 . .	26,308	143,317	169,625	1·9	10·6	12·4	3·0	1 to 5·5

Bayonet and Sword Statistics. It is a significant fact that the number of injuries sustained from side-arms, even in the earlier days of muskets, has hitherto been trifling as compared with those sustained from other causes.

Stevenson says: "Bayonet and sword wounds, as well as those of all other kinds of side-arms, do of course occur; but their frequency is so insignificant, as compared with that of rifle projectiles, that they may almost be set aside. Field-guns and portable fire-arms have in recent years reached such a pitch of perfection, and are so destructive to fighting men, and at such long distances, that but little opportunity arises for injuries from other kinds of weapons to occur in warfare. The men of almost every branch of the service in all armies are nowadays supplied with a fire-arm of one kind or another—rifle, carbine, or revolver."

Medical-Inspector-General Delorme of the French Army, in his "Traité de Chirurgie de Guerre," sets forth the percentage of wounds derived from side-arms in the wars between 1850 and 1900, as being from 2 to 3 per cent.

The history of the war in America shows the percentage of such wounds as 0·37 per cent. During this war, out of a number of 246,000 men wounded, only 922 of the wounds were traceable to side-arms.

In the Crimea, according to Matthew, the English Army sustained 10,129 cases of wounded,

so far as the hospitals accounted. Of these only 1·5 per cent. were from side-arms.

Fischer's statistics of the war of 1870 set forth that out of a total of 54,268 wounds, side-arms accounted for 1·4 per cent.

The "Russki-Invalid" of December 8 and 9, 1906, is responsible for the statement that in the Russo-Japanese War, between 1904 and 1905, the Russian percentage was 1·7 per cent. of such wounds.

Arriving at more recent campaigns, we find during the Balkan War, quite to the contrary, a prevalence of bayonet and sword wounds, to such an extent that the proportion is stated to have been about 10 per cent. in these wars. Thus the statistics of the present conflict, when they are compiled, may create some surprise in this respect.

APPENDIX I

EXTRACTS FROM THE

APPENDIX TO THE CONVENTION (1907)

REGULATIONS RESPECTING THE LAWS AND CUSTOMS OF WAR ON LAND

SECTION II: OF HOSTILITIES

CHAPTER I: MEANS OF INJURING THE ENEMY, SIEGES, AND BOMBARDMENTS

Article 22

BELLIGERENTS have not got an unlimited right as to the choice of means of injuring the enemy.

Article 23

Besides the prohibitions provided by special Conventions, it is especially prohibited:

(*a*) To employ poison or poisoned arms;

(*b*) To kill or wound treacherously individuals belonging to the hostile nation or army;

(*e*) To employ arms, projectiles, or material calculated to cause unnecessary suffering:

The above Articles were adopted at the fourth Plenary Meeting held at The Hague on August 17, 1907.

Major-General Baron Giesl de Gieslingen (Austria-Hungary) who had acted as Reporter of the Committee, made the report and read the Text to the Meeting.

On July 6, 1899, Sir Julian Pauncefote, in a letter to

the Marquess of Salisbury, encloses a memorandum drawn by Sir John Ardagh, in which the latter reports as follows:

"Article 23 (E) enounces a sound principle, and does not affect weapons or projectiles which conform to it."

APPENDIX II

* EXTRACTS FROM THE

HAGUE CONVENTION (No. 4) 1907

CONCERNING THE LAWS AND CUSTOMS OF WAR ON LAND

BEING animated also by the desire to serve, even in this extreme hypothesis, the interests of humanity and the ever-increasing requirements of civilization.

Thinking it important, with this object, to revise the general laws and customs of war, with the view on the one hand of defining them with greater precision, and, on the other hand, of confining them within limits intended to mitigate their severity as far as possible.

Have deemed it necessary to complete and render more precise in certain particulars the work of the First Peace Conference, which, following on the Brussels Conference of 1874, and inspired by the ideas dictated by a wise and generous forethought, adopted provisions intended to define and regulate the usages of war on land.

Article 1

The Contracting Powers shall issue instructions to their armed land forces, which shall be in conformity with the Regulations respecting the Laws and Customs of War on Land annexed to the present Convention.

* Only the wording bearing upon the questions herein at issue is quoted, similarly articles having no reference to the same are deleted.

Article 3

The belligerent Party who shall violate the provisions of the said Regulations shall be bound, if the case arises, to pay an indemnity.

It shall be responsible for all acts done by persons forming part of its armed force.

APPENDIX III

ANNEX II

(*Translation*)

DECLARATION

RESPECTING ASPHYXIATING GASES

THE Undersigned, Plenipotentiaries of the Powers represented at the International Peace Conference at The Hague, duly authorized to that effect by their Governments, inspired by the sentiments which found expression in the Declaration of St. Petersburg of the 29th November (11th December), 1868,

Declare that:

The Contracting Powers agree to abstain from the use of projectiles the object of which is the diffusion of asphyxiating or deleterious gases.

The present Declaration is only binding on the Contracting Powers in the case of a war between two or more of them.

It shall cease to be binding from the time when, in a war between the Contracting Powers, one of the belligerents shall be joined by a non-Contracting Power.

The present Declaration shall be ratified as soon as possible.

The ratifications shall be deposited at The Hague.

A *procès-verbal* shall be drawn up on the receipt of each ratification, a copy of which, duly certified, shall be sent through the diplomatic channel to all the Contracting Powers.

The non-Signatory Powers can accede to the present Declaration. For this purpose they must make their accession known to the Contracting Powers by means of a written notification addressed to the Netherland Government, and by it communicated to all the other Contracting Powers.

In the event of one of the High Contracting Parties denouncing the present Declaration, such denunciation shall not take effect until a year after the notification made in writing to the Government of the Netherlands, and forthwith communicated by it to all the other Contracting Powers.

This denunciation shall only affect the notifying Power.

In faith of which the Plenipotentiaries have signed the present Declaration, and have affixed their seals thereto.

Done at The Hague, the 29th July, 1899, in a single copy, which shall be kept in the archives of the Netherland Government, and copies of which, duly certified, shall be sent through the diplomatic channel to the Contracting Powers.

(Here follow the signatures.)

NOTE

The following Powers acceded to both the above Declarations, respecting expanding bullets and asphyxiating gases, on the dates mentioned :

Austria-Hungary . .	September 4, 1900.
China	November 21, 1904.
Germany	September 4, 1900.
Italy	September 4, 1900.
Japan	October 6, 1900.

Luxemburg . . .	July 12, 1901.
Servia	May 11, 1901.
Switzerland . . .	December 29, 1900.

Portugal also acceded on August 29, 1907, to the Declaration respecting expanding bullets.

APPENDIX IV

(*Translation*)

CONVENTION (No. 8) RELATIVE TO THE LAYING OF AUTOMATIC SUBMARINE CONTACT MINES

INSPIRED by the principle of the freedom of the seas as the common highway of all nations;

Seeing that, while the existing position of affairs makes it impossible to forbid the employment of automatic submarine contact mines, it is nevertheless expedient to restrict and regulate their employment in order to mitigate the severity of war and to ensure, as far as possible, to peaceful navigation the security to which it is entitled, despite the existence of war;

Until such time as it may be found possible to formulate rules on the subject which shall ensure to the interests involved all the guarantees desirable;

Have resolved to conclude a Convention to this effect, and have appointed as their Plenipotentiaries, that is to say:

(Names of Plenipotentiaries.)

Who after having deposited their full powers, found to be in good and due form, have agreed upon the following provisions:

Article 1

It is forbidden:

(1) To lay unanchored automatic contact mines, unless they be so constructed as to become

harmless one hour at most after the person who laid them has ceased to control them ;

(2) To lay anchored automatic contact mines which do not become harmless as soon as they have broken loose from their moorings ;

(3) To use torpedoes which do not become harmless when they have missed their mark.

Article 2

The laying of automatic contact mines off the coast and ports of the enemy with the sole object of intercepting commercial shipping is forbidden.

Article 3

When anchored automatic contact mines are employed, every possible precaution must be taken for the security of peaceful shipping.

The belligerents undertake to do their utmost to render these mines harmless after a limited time has elapsed, and, should the mines cease to be under observation, to notify the danger zones as soon as military exigencies permit by a notice to mariners, which must also be communicated to the Governments through the diplomatic channel.

Article 4

Neutral Powers which lay automatic contact mines off their coast must observe the same rules and take the same precautions as are imposed on belligerents.

The neutral Power must give notice to mariners in advance of the places where automatic contact mines have been laid. This notice must be communicated at once to the Governments through the diplomatic channel.

Article 5

At the close of the war, the Contracting Powers undertake to do their utmost to remove the mines which they have laid, each Power removing its own mines.

As regards anchored automatic contact mines laid by one of the belligerents off the coast of the other, their position must be notified to the other Party by the Power which laid them, and each Power must proceed with the least possible delay to remove the mines in its own waters.

Article 6

The Contracting Powers which do not at present own perfected mines of the description contemplated in the present Convention, and which, consequently, could not at present carry out the rules laid down in Articles 1 and 3, undertake to convert the *matériel* of their mines as soon as possible, so as to bring it into conformity with the foregoing requirements.

Article 7

The provisions of the Present Convention do not apply except between Contracting Powers, and then only if all the belligerents are parties to the Convention.

Article 8

The present Convention shall be ratified as soon as possible.

The ratifications shall be deposited at The Hague.

The first deposit of ratifications shall be recorded in a Protocol signed by the Representatives of the Powers which take part therein and by the Netherland Minister for Foreign Affairs.

The subsequent deposits of ratifications shall be made by means of a written notification addressed to the

Netherland Government and accompanied by the instrument of ratification.

A duly certified copy of the Protocol relating to the first deposit of ratifications, of the notifications mentioned in the preceding paragraph, and of the instruments of ratification, shall be immediately sent, by the Netherland Government, through the diplomatic channel to the Powers invited to the Second Peace Conference, as well as to the other Powers which have acceded to the Convention. The said Government shall, in the cases contemplated in the preceding paragraph, inform them at the same time of the date on which it received the notification.

Article 9

Non-Signatory Powers may accede to the present Convention.

A Power which desires to accede notifies its intention in writing to the Netherland Government, forwarding to it the act of accession, which shall be deposited in the archives of the said Government.

The said Government shall immediately forward to all the other Powers a duly certified copy of the notification, as well as of the act of accession, mentioning the date on which it received the notification.

Article 10

The present Convention shall take effect, in the case of the Powers which were parties to the first deposit of ratifications, sixty days after the date of the Protocol recording such deposit, and, in the case of the Powers which shall ratify subsequently or which shall accede, sixty days after the notification of their ratification or of their accession has been received by the Netherland Government.

Article 11

The present Convention shall remain in force for seven years, dating from the sixtieth day after the date of the first deposit of ratifications.

Unless denounced, it shall continue in force after the expiry of this period.

The denunciation shall be notified in writing to the Netherland Government, which shall immediately communicate a duly certified copy of the notification to all the Powers, informing them of the date on which it was received.

The denunciation shall only operate in respect of the denouncing Power, and only on the expiry of six months after the notification has reached the Netherland Government.

Article 12

The Contracting Powers agree to reopen the question of the employment of automatic contact mines six months before the expiry of the period contemplated in the first paragraph of the preceding Article, in the event of the question not having been already taken up and settled by the Third Peace Conference.

If the Contracting Powers conclude a fresh Convention relative to the employment of mines, the present Convention shall cease to be applicable from the moment when it comes into force.

Article 13

A register kept by the Netherland Ministry for Foreign Affairs shall record the date of the deposit of ratifications effected in virtue of Article 8, paragraphs 3 and 4, as well as the date on which the notifications of accession (Article 9, paragraph 2) or of denunciation (Article 11, paragraph 3) have been received.

Each Contracting Power is entitled to have access

to this register and to be supplied with duly certified extracts from it.

In faith whereof the Plenipotentiaries have appended their signatures to the present Convention.

Done at The Hague, the 18th October, 1907, in a single original, which shall remain deposited in the archives of the Netherland Government, and of which duly certified copies shall be sent, through the diplomatic channel, to the Powers invited to the Second Peace Conference.

APPENDIX V

SIR J. PAUNCEFOTE TO THE MARQUESS OF SALISBURY

(*Received July* 21.)

THE HAGUE, *July* 20, 1899

MY LORD,

IN my despatch of the 20th June I forwarded to your Lordship a copy of the Report of the Second or Naval Sub-Commission of the First Commission dealing with the 2nd, 3rd, and 4th Articles of Count Mouravieff's Circular of the 30th December, 1898.

Your Lordship will observe from that Report that when the question of interdicting the employment of asphyxiating gases was discussed, the result of the voting is summed up as follows: "quatorze Représentants ont admis—toujours pour le cas d'une unanimité—la possibilité d'une interdiction de cette qualité de projectiles à gaz asphyxiants."

The British Delegate, Sir John Fisher, voted with the fourteen States above referred to, while the Delegates of the United States recorded their vote in the negative.

The question was again brought up to-day at a plenary Meeting of the First Commission to consider its proposed Report to the Conference, of which a copy is inclosed.

Captain Mahan was pressed by the President to withdraw his adverse vote for the sake of unanimity, but he declined to do so. A vote was then taken on the proposal (see the Report) to recommend to the Conference a Convention or Declaration containing the three prohibitions specified in Section I. After some discus-

sion separate votes were taken on the question as it affected each of those prohibitions. Great Britain and the United States voted affirmatively as regards the first, and negatively as regards the second and third.

I inclose a Memorandum on the subject by Sir John Fisher.

I have, etc.

(Signed) JULIAN PAUNCEFOTE.

APPENDIX VI

MEMORANDUM FROM SIR J. FISHER TO THE MARQUESS OF SALISBURY, JULY 20, 1899, UPON THE QUESTION OF ASPHYXIATING GASES

When the question of the interdiction of asphyxiating shell was originally brought forward at the second Sub-Commission of the First Commission, Sir John Fisher (on humanitarian grounds), joined in the vote for their interdiction, but on the distinct understanding that the vote was unanimous. It was obvious that if asphyxiating shell were adoped by any one nation, other nations could not avoid their use.

On Captain Mahan (the United States Naval Delegate) being pressed to-day by the President at the meeting on the first Commission to withdraw his original voice in favour of the employment of asphyxiating shell, he reiterated his argument that he considered the use of asphyxiating shell far less inhuman and cruel than the employment of submarine boats, and as the employment of submarine boats had not been interdicted by the Conference (though specially mentioned with that object in the Mouravieff Circular), he felt constrained to maintain his vote in favour of the use of asphyxiating shell on the original ground that the United States Government was averse to placing any restriction on the inventive genius of its citizens in inventing and providing new weapons of war.

The vote being then put to the Commission, " Yes " or " No," whether the Commission should recommend

in its report a Declaration or Convention prohibiting the use of asphyxiating shells, and the United States Delegates having voted against that proposal, Sir Julian Pauncefote voted in the same sense.

(Signed) J. A. FISHER.

July 20, 1899.

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